Pit and Quarry

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AUGMENTING INTEREST IN SAFETY

ONE of the best ways to make an employee a keen supporter of safety is to assign him responsibility for the promotion of the safety movement. The personal contact with actual problems that he will get while a member of the safety committee of his plant or department, together with the constructive guidance that the management provides such committees will cause him to become an active booster for safety and cooperation at all times.

The plan of having safety committees made up of workers from various sections of the establishment is one of the most effective methods in use. Members of these committees should receive constant guidance and instruction in the underlying principles of safe practices and methods. Membership should be rotated through the entire personnel, so that as many different workers as possible will have the opportunity of some time serving on the safety committee.

It is most essential, of course, that the proper employees be chosen when the plan is inaugurated. Only such workers can assure confidence in the idea, help to develop that spirit which makes for success, or assist in inculcating new employees with the safety idea. Each member should serve for a period of two or three months, but this will depend entirely upon individual plant conditions. In some organizations the committee members are chosen and instructed by their respective foremen, while in others the factory superintendent selects the men for this work and the responsibility for instruction is assumed by a permanent safety council.

In practically all cases it has been found advisable to include only rank and file employees in these committees. The presence of a supervising official or executive head freezes the workers into silence and thus fails to bring out the freer and franker discussions and inspections so essential to success. Suitable badges for members are frequently helpful, both for the authority they signify and for the effect they have upon the employee. Group photographs of the safety committee are also used to build up a spirit of pride in the organization, these being posted on the bulletin boards or reproduced in the plant house organ.

Employee's safety committees should make regular inspections, on company time, at least once a month. If the situation requires it, extra inspections are made, as when an accident occurs or an imminent breakdown is noticed. Such inspections should include safeguarding, fire hazards, cleanliness, and all conditions pertaining to the safety and welfare of the men. Under this system it is comparatively easy to arrange safety contests or carry foreward "no-accident campaigns," which are usually resultful in minimizing injuries and reducing the toll of accidents.

One Ohio firm that has been employing the "worker's committee" idea to advantage provides each committee with a suitable inspection form, this form acting as a guide when the plant inspections are made and reported upon. We outline below the character of this form since it is semi-universal in application and might conceivably be used by almost any size or type of plant.

The report of each committee should be made in writing and submitted to the foreman or superintendent of the department under consideration. A copy should be retained by the committee secretary or "chairman," and in some cases a third copy is sent to the safety engineer, or the superintendent of maintenance. The following outline is self-explanatory:

SAFETY INSPECTION REPORT

Note: Thorough inspections are to be made each month by the Safety Committee, and reports rendered on this form. Where the equipment listed is found to be in a satisfactory condition, indicate this fact by the word "Good." File separate reports for each department. If defective or unsafe conditions are discovered, explain the nature of the defect and the proposed remedy in full under the heading "Recommendations." Be sure to submit a separate, detailed report for each department.

Names of members on committee: .....
Department reported upon: .....
Date of inspection .....Date, last inspection .....

1. Yards and approaches:
   - (a) Condition of pavements and grounds .....
   - (b) Are chauffeurs and truckers using all reasonable precautions? State fully .....
   - (c) Are materials handled safely? .....
   - (d) Are materials piled safely? .....
   - (e) Condition of loading platforms .....
   - (f) Condition of railroad tracks .....
   - (g) Are crossings properly guarded? .....

(h) Condition of bumping blocks .....
(i) Is there safe clearance between railroad tracks and piles of material or parked cars? .....
(j) Is switching of cars done safely? State fully .....
(k) Condition of cranes, derricks, outside machines, etc. .....

2. Building conditions:
(a) Walls .....(b) Foundations .....
(c) Snow .....(d) Ice .....
(e) Doors .....(f) Windows .....
(g) Floors .....(h) Floor traps .....
(i) Platforms .....(j) Elevated runways ...
(Floor traps or openings, platforms or elevated runways should be free from all obstructions, and protected with double handrails and toeboards.)

3. Stairways:
(a) Is proper light provided? .....
(b) Condition of supports and handrails .....
(c) Are treads badly worn or do nail heads protrude? .....

4. Aisles and Passageways:
(a) Are they properly marked off? .....
(b) Are they kept clear of obstruction? .....

5. Transmission machinery:
(a) Is safe equipment installed, or proper guards provided? .....
(Watch for protruding set screws, unguarded shafting, belts, pulleys, gears, couplings, etc.)

6. Machine tools:
(a) State what guards are not in use, or where they are needed .....
(b) Can the point of operation be more efficiently guarded? .....

7. Elevators, cranes, and other hoisting machinery:
(a) Condition of gates .....
(b) Condition of cables, or wire ropes .....
(c) Condition of machinery .....
(d) Hooks, chains, rings, etc .....
Safety devices .....
(e) Walks, stairs, ladders, cages, platforms, etc. .....

8. Fire hazards:
(a) Does each member of the committee know the location and understand the operation of the nearest shut-off valve controlling the sprinkler system? .....
(b) Are all fire doors unobstructed and in good condition? .....
(c) Condition of emergency exits, fire escapes, and approaches? .....
(d) Condition of ordinary exits and approaches .....
(e) Give complete list (number and condition) of all fire fighting equipment in department .....
Sprinklers .....Sand pails .....Water buckets .....Chemical extinguishers .....Hose stations and hose .....
(f) Are all the above items unobstructed and ready for use? .....
(g) Date of last fire drill .....Time required to empty? .....

9. Explosion hazards:
(a) Are all solid, liquid, or gaseous explosives properly stored and handled carefully? .....

10. Ladders:
(a) Number in department .....Condition .....
(b) Have all ladders safety feet? .....

11. Trucks and wheelbarrows:
(a) Number of trucks .....Condition .....
(b) Number of wheelbarrows ....Condition .....

12. Electrical equipment:
(a) Note and report in full all defects in wiring, fixtures and equipment .....

13. Hand tools:
(a) Condition .....

14. Goggles, respirators, masks, helmets, etc.:
(a) Has this type of equipment been provided in sufficient amount? .....
(b) Are they properly used when necessary? .....

15. Light:
(a) Are windows and skylights clean? .....
(b) Electric lights and reflectors? .....

16. Sanitation, condition of:
(a) Toilets .....Urinals .....
(b) Washing facilities .....Drinking fountains ....

17. Ventilation:
(a) Report condition of air, heat, humidity, dust, fumes, etc. .....

18. First aid:
(a) Is proper equipment contained in first aid kit?...
(b) Is the person in charge of first-aid adequately instructed? .....
(c) Is stretcher in good condition and properly located? .....

19. Unsafe practices:
Note and report fully .....

20. General recommendations:
.....
.....
.....

Where maintenance work of all physical property is carried forward in a systematic and periodic basis, a copy of these monthly safety inspection reports may assist the maintenance engineer in his work. Indeed, in one plant the safety inspections have been amplified to include all physical property and thus does the maintenance engineer have submitted to him a conclusive report showing the status of all property, once a month. From this he can determine needed replacements or make individual or special inspections. If properly conducted such monthly inspections, made in the interest of safety, will serve this double purpose.

BECOMING POOR AMONG GREAT RICHES

POPULAR conception is frequently a very misleading thing. In general the by and large public knows that the Dakotas have been sadly involved with state controlled business which has so far sunk North Dakota in the mire of bonded indebtedness that it will require a full general of hard work, with no set backs, to pull it out, while South Dakota has burdened itself with the heaviest per capita indebtedness of any state in the Union due almost entirely to its ventures in state ownership and administration of private industries.

On the other hand the same man thinks of Michigan as a progressive, up-and-coming Republican commonwealth that is making money for itself and its country; a state untouched by the blight of state ownership. Therein lies an example of erroneous popular conception.

Not long ago the state government of Michigan issued a public statement that henceforth it would erect its own buildings, since it could do so much cheaper and better than private contractors. This paper bomb gave rise to a fact finding commission, and briefly here are the facts. The state of Michigan is now engaged in the manufacture of twine, overalls, boots and shoes, cement, granite quarrying, contracting and construction, farm loans and several other lines of lesser importance. All of these activities are in direct competition with private industry. That such activity is costing Michigan a pretty sum is evidenced by the single fact that in the construction of an eight mile stretch of concrete highway the State spent about $50,000 a mile, whereas if private enterprise had been employed the same stretch of road would have cost about $27,000 a mile.

NEW MODEL SILICA SAND PLANT COMPLETED BY UNITED STATES SILICA COMPANY

THE plant of the U. S. Silica Company at Ottawa, Illinois, which was designed by Allen and Garcia, has many unique features for producing an exceptionally high grade product. The new drying house, recently constructed, probably has no counterpart anywhere in the country. The company owns a 64 acre deposit two miles from the city of Ottawa of which about 5 acres are now being worked. The deposit is snake holed with Star drills to a horizontal depth of about 30 feet and broken out with 80 to 100 pound charges of 40 percent gelatine dynamite.

The breast of the silica sand rock face averages 65 feet in height and is about 3,000 feet long. The sand is hydraulically washed down to a sump by a hose with 125 pounds water pressure where it is picked up by a heavy duty vacuum type pulsometer pump specially designed by the company's engineers, and capable of pumping 150 tons of sand per hour and of handling up to 70 per cent solids.

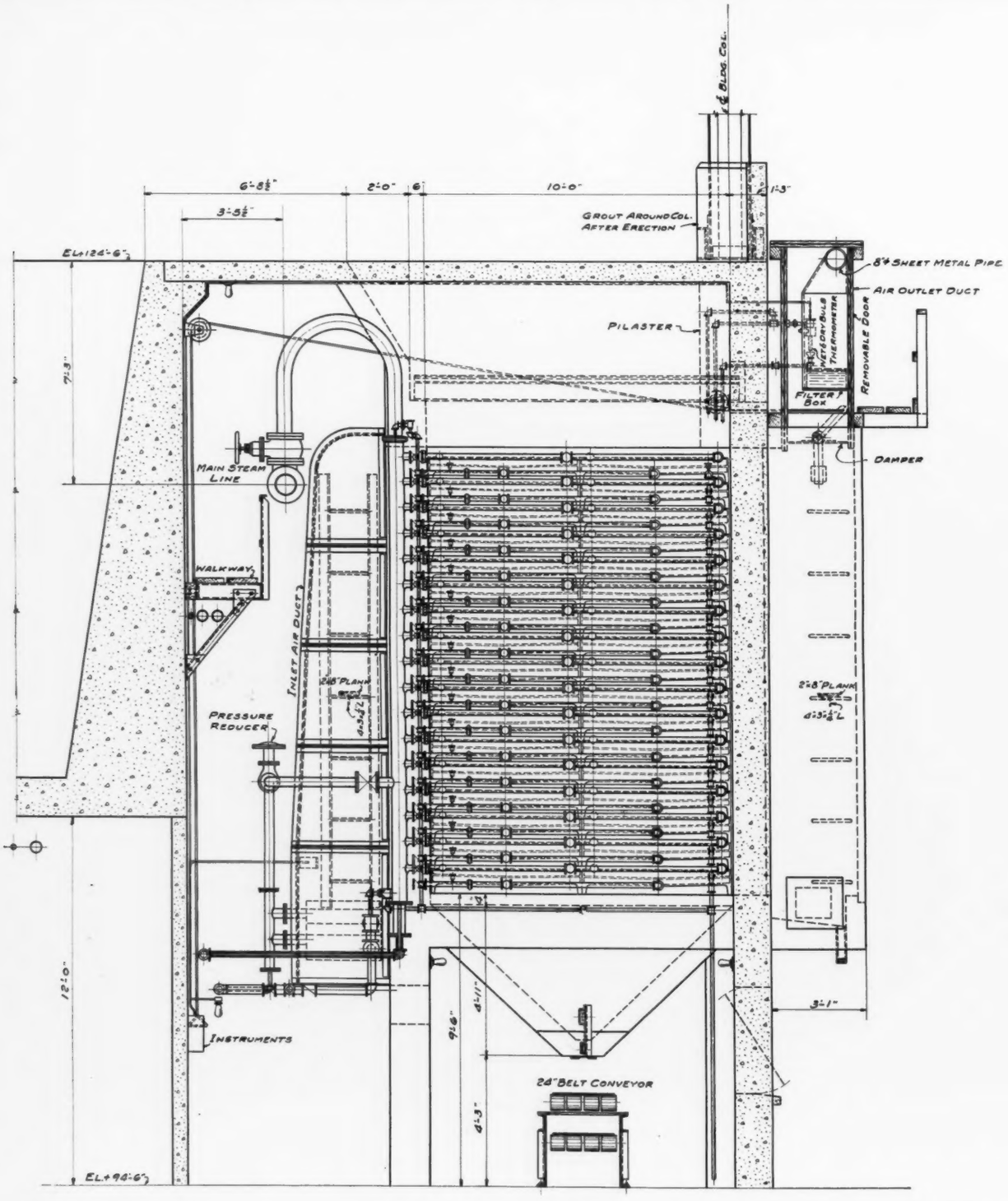
This pump takes up the sand and water at the sump and forces it through a 5 inch pipe a distance of 300 feet discharging on to a drag elevator on 175 foot centers driven by a 75 h. p. General Electric motor. This elevator delivers the product to a 6 to 12 mesh wire screen tacked on to a wooden frame, through which the sand and water fall to the concrete wash bins. There are two of these bins with a capacity of 250 tons each. From these bins a vacuum type pulsometer pump delivers the

A. V. Foster, President

A Portion of the Excellent Silica Deposit

sand and water through a five inch pipe for a distance of 100 feet to one of four drain bins in the newly constructed dryer plant. These drain bins are of concrete construction 40 feet long by 35 feet wide by 17 feet deep. Each have a capacity of 1,000 tons of damp sand. In the older plant there are 12 smaller drain bins with a capacity of 175 tons each, giving the plant a total drain capacity of 6,000 tons.

The new drain bins are of novel construction and instead of having a filter bottom as is the usual arrangement are each equipped with nine draining pots which have movable cylinders containing filtering material and are protected by a screen, top and bottom. These filter pots are packed with filtering material, which, in this case, consists of gravel and cinders which are graded from fine to coarse. The drainage pots have been very satisfactory in their operation. They yield a clear water with no loss of sand and the capacity of the nine pots is such that it is difficult to maintain enough water to flush the sand uniformly into the bin. They can be easily renewed when necessary.



End Elevation of Sand Dryers

The water from the drainage pots is collected into a series of launders and taken directly to the plant waste.

From the drain bins the sand is picked up by a two yard Williamson bucket attached to a 7½ ton P. & H. overhead crane driven by four motors with a total of 125 h. p., two of the motors being for electric brake release, and this bucket unloads the sand into the dryers. Drying is accomplished both by steam and air, the dryers having a capacity of 25 tons per hour each. Two dryers are now in operation and four additional dryers will be available when the plant is running at full capacity.

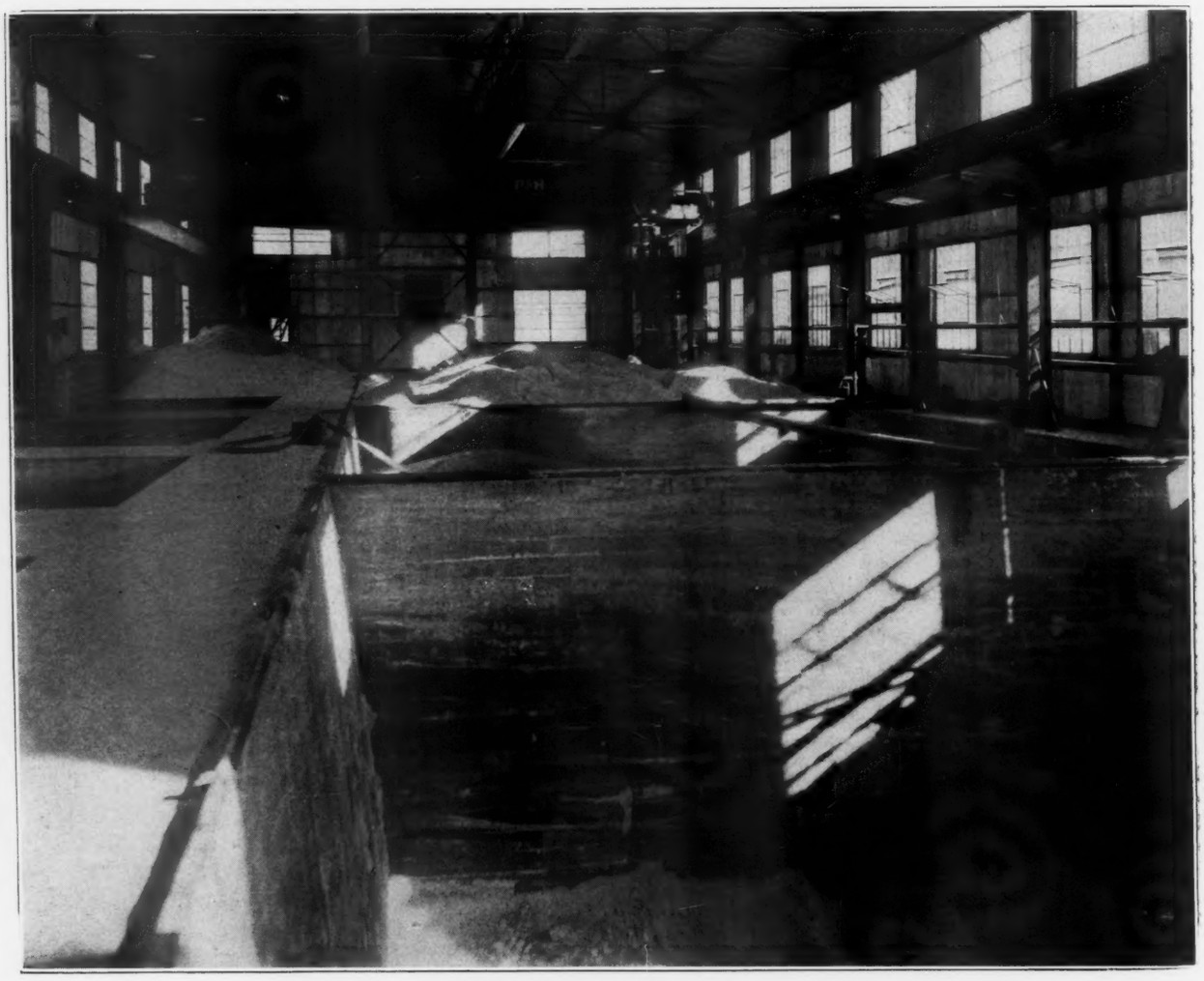
The driers employ direct drying from steam-heated pipes in combination with preheated air with mechanical draft. The design of these driers was the result of much experimentation on the part of Mr. Foster and Mr. Witt, and the size and arrangement of the pipes, together with the novel construction of headers, arrangement for expansion, etc., were very carefully worked out and tried before the designs of the new plant were prepared.

The use of preheated air is new in driers in this field. The air is heated by means of Aerofin heaters and is taken from the room space below the driers.

W. J. Witt, Superintendent

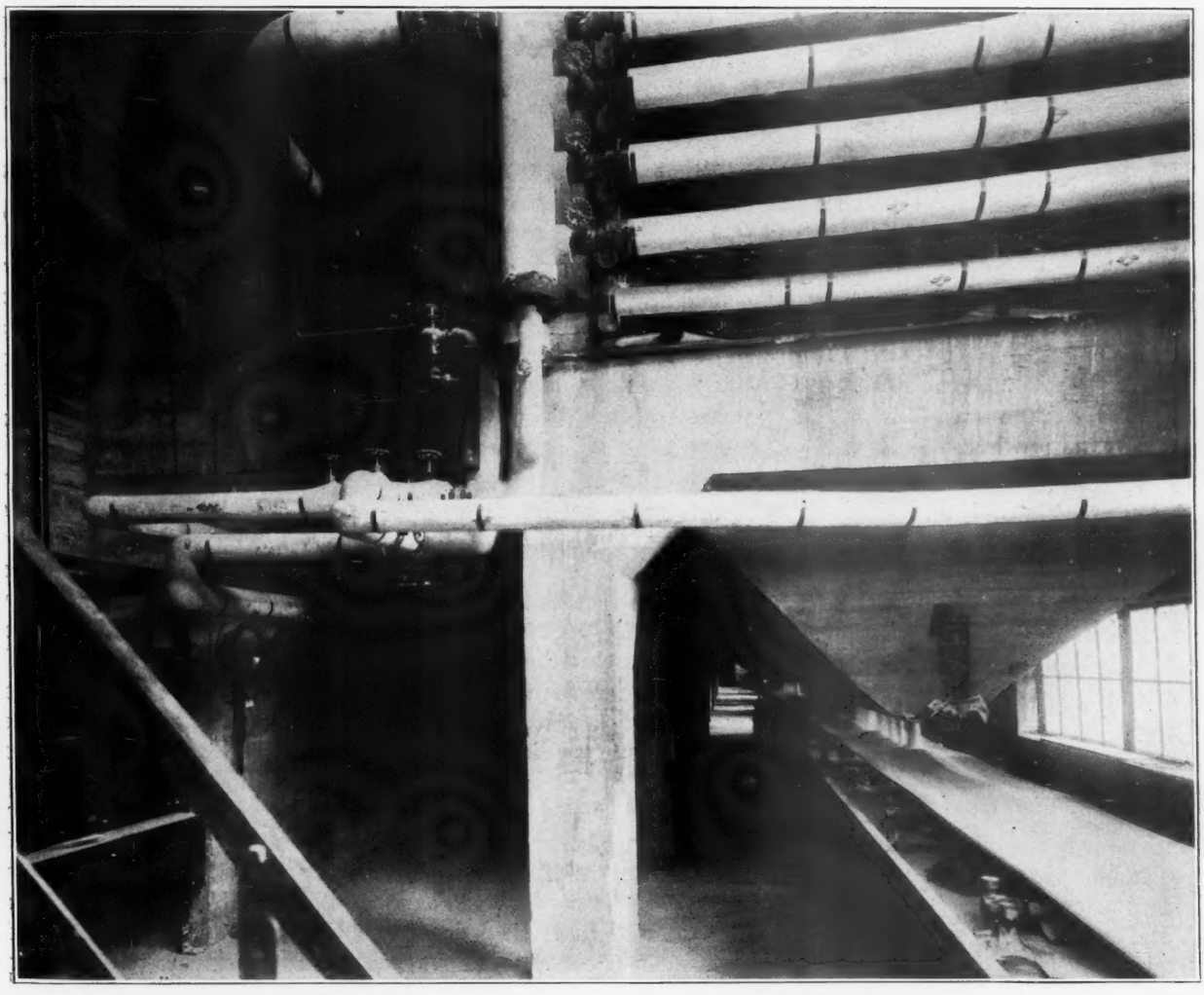
View in Pit Showing Feed to Pump

Showing Method of Loading Conveyor From Hoppers Which Are Directly Below the Dryers



The Concrete Drain Bins

The Screening Plant



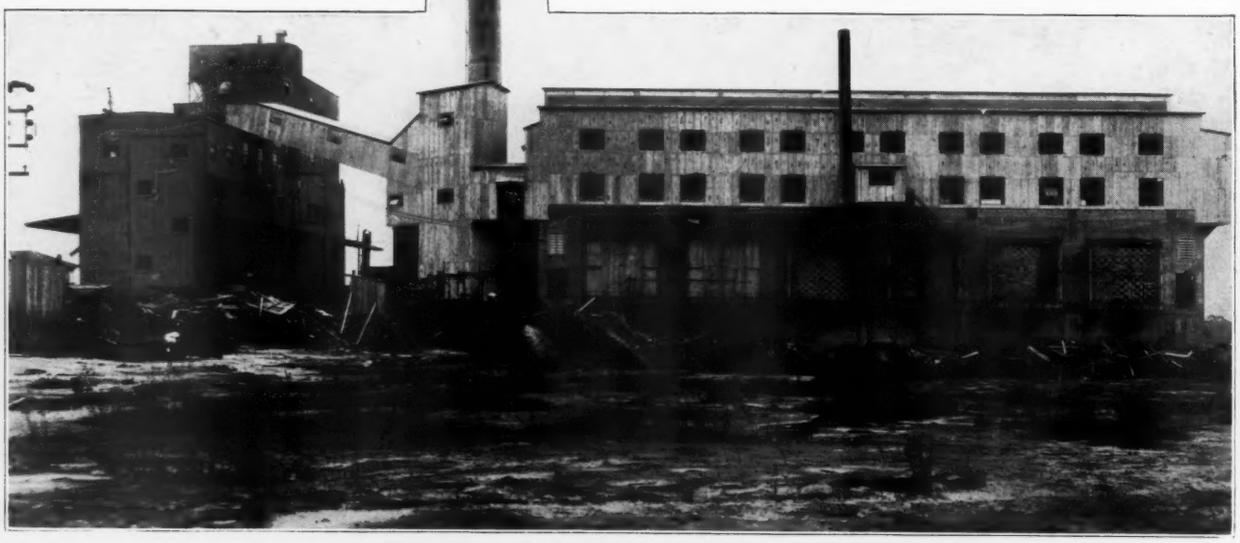
Preheated Air Is Used In These Dryers. Belt Conveyor at Right Receives the Silica Sand Through Hoppers As Shown

It is drawn through the driers via angle-iron ducts, which are simply inverted angles supporting the pipes, the preheated air being in contact with the sand throughout the width of the drier, thus making it possible to eliminate the moisture immediately after it has left the sand and carried it away without lowering the temperature below the dew point.

The current of air through these ducts is such as not to disturb nor carry away the sand.

process, which is used in the manufacture of sand of extremely low iron content necessary to meet the requirements of glass manufacturers where the color of the glass is of importance, has been developed in order to submit large quantities of sand to the highest possible magnetic intensity and makes use of a large capacity magnetic pulley with the material passing directly over the bare face of the pulley instead of over a belt as is the usual practice.

After the sand is submitted to intensive washings which eliminate the alumina and other non-magnetic materials contained in the sand stone it is then fed by gravity from a large hopper in a thin stream, directly onto the bare ace of a 48 inch



The New Plant of the United States Silica Company

Each duct is controlled by a hand-operated damper. Air supplied to each of the driers is also controlled by a damper which is operated by a chain from a convenient point between the driers.

From the dryers the sand is discharged through concrete hoppers by gravity on to a 24 inch conveyor belt on 160 foot centers driven by a 10 h. p. Westinghouse motor which delivers the product to a Weller continuous bucket elevator on 65 foot centers driven by a 15 h. p. Westinghouse motor which discharges on to a 24 inch belt conveyor on 65 foot centers driven by a 10 h. p. motor. This belt conveys the sand to 26 Tyler whiptaps which makes 2 seperations producing three grades of sand, viz., the coarsest a sand blast sand, a medium grade for the glass industry and a 50 mesh banding sand for roofing, non-ferrous castings and blasting sand for matte finish.

An unusual method of separating from glass sand all magnetic material, such as hematite, magnetitie, ilmenite, minute particles of iron abraded from the surfaces of crushers, screens or other iron machinery and even particles of iron attached to sand crystals, or entirely included in them, has been installed by the United States Silica Company. The Dings magnetic pulley on which the maximum current is carried. The extremely high magnetic intensity causes all particles of magnetic material such as hematite, magnetite, iron of abrasion, etc., to adhere to the face of the pulley including even the crystals with iron attached or iron entirely included within themselves.

In order to remove magnetic particles collected on the face of the pulley a special control mechanism has been installed which demagnitizes the pulley for a few seconds approximately once every minute. At the same time a stiff brush extending the full width of the pulley is brought to bear against the pulley face on the back side. This brush, operating while the pulley is demagnetized for a second or two removes all magnetic particles which have been seized, the collected magnetic particles falling into another chute.

Immediately the face of the pulley has been brushed clean, the magnetizing current is again applied by the automatic control mechanism. The entire cycle is repeated approximately once a minute. The design of the apparatus and automatic control was worked out by engineers of the Dings

(*Continued on page 75*)

CEMENT AND QUARRY OPERATORS RECOGNIZE IMPORTANCE OF SAFETY WORK

SEVERAL thousands interested in safety and accident prevention work came to Chicago during the week of September 26th to attend the sessions of the Sixteenth Annual Safety Congress of the National Safety Council. The meetings of the Cement Section and the Quarry Section were particularly of interest to Pit and Quarry readers.

Cement Section

The first meeting of the cement section opened at 9:50 a. m. on Tuesday, September 27th at the Stevens Hotel. E. Frame, insurance manager of the Alpha Portland Cement Company was chairman of the meeting. Mr. Frame made a welcoming talk to the seventy-six delegates present at the meeting, commented upon the splendid record made by the cement mills in safety work during the past year and then introduced J. B. John, president of the Sandusky Cement Company of Cleveland and chairman of the committee on accident prevention and insurance of the Portland Cement Association.

Mr. John outlined the past year's work of the committee of which he is chairman and said that the award of the Safety trophy had not only helped the companies to reduce accidents but had also produced a large amount of community publicity which helped the companies' public relations. At the start of the campaign one or two companies succeeded in going through the year with only eight or ten lost time accidents, he said. In 1926 two companies managed to go through the entire year with no lost time accidents, whereas, in 1927 to date, twenty-three cement plants had had no lost time accidents. With such an imposing array of trophy winners, the cost of trophies is getting to be a serious matter, as with the attendant traveling expenses of the two association representatives, they cost about $1000 each.

Mr. John commented on the fact that, while the plant operators and superintendents first resented the idea of having someone from the outside coming in to tell them how to conduct their business, conditions now are different and there is the heartiest cooperation between the plant men and the safety men. The success of any safety man, Mr. John said, is determined by the interest he has in the welfare of the men in the plant and not by his interest in a bigger salary.

The next subject on the program was the report of officers and analysis of accident statistics. This was given by A. R. J. Curtis, secretary of the Cement Section of the National Safety Council and assistant to the general manager of the Portland Cement Association. Mr. Curtis reported that there were 79 members in the Cement Section, a gain of 13 over the previous year; that there was a reduction in accidents from a total of 2541 in 1925 to 2174 in 1926, and in lost time accidents of from 61 to 45. The intensive June "No accident" campaign of this year resulted in 142 less injured and 5 less fatalities than in the previous year. The entire number of cement plants went through the month of June with only 26 per cent of the normal number of accidents and all of the plants of the Lehigh Portland Cement Company went through the month without an accident. In July, 1927, there were twice as many accidents as in June but less than in July, 1926 and in 1927 to date there were 400 less lost time accidents and 8 less fatalities than in 1926. The reporting system, Mr. Curtis said, is the backbone of the whole success of the safety campaign. He urged the plant operators to redouble efforts in the Fall, when, for some reason not altogether apparent, accidents generally increase. Some plan must be found to interest the plant that has had accidents which put them out of the trophy contest. Of the 22 fatalities in 1926, four were due to slides, 4 to cars, 3 to contact with machinery, 2 to screw conveyors, 2 to burning, 4 to electrocution, 1 to explosives, 1 to drowning and 1 to bucket falling. Packing houses, Mr. Curtis said, seem to be a prolific source of minor accidents.

W. P. Sabin, assistant to the president of the Ash Grove Lime and Portland Cement Company of Kansas City, next spoke on the subject of "How To Interest Workmen In Their Own Safety." Mr. Sabin's talk fairly bristled with ideas for getting everyone interested in the safety idea. At his plant the employees are divided into teams each wearing a different colored mule emblem and a large board depicts the progress of the mule teams. For a perfect no lost time accident day each mule moves forward six spaces on the board and various penalties are given when a team member has an accident. The company has had no lost time accidents since March, 1926, and believes this is due largely to the team idea which makes an employee's fellow team members shun him when he takes hazards. The company also has a secret service system by which they are able to detect and remove potential accident hazards.

Mr. W. R. Dunne of the Vulcanite Portland Cement Company in starting off the discussion of the above talks urged a larger attendance and said that he intended to send some of the younger plant executives to the safety meetings in the future. He suggested that in order to bring the safety idea home to the men each day he was going to ask them to salute the plant safety flag on going to work every morning. In case the trophies get too expen-

sive for the association to bear he suggested that the individual companies pay for same.

Mr. D. Adam of the Lawrence Portland Cement Company suggested that Mr. Curtis visit more of the plants in person to teach the safety idea. Mr. C. F. Stoddard of the Department of Labor Statistics of the Bureau of Mines, urged a more careful and more regular compilation of safety statistics of cement plants. Mr. G. F. Halpin of the Marquette Cement Company asked if there were any new safety ideas for use in 1928 and Mr. Curtis answered that as the old plans had worked, they would be continued. Adjournment for lunch was taken at 12:30 p. m.

Cement and Quarry Sections

The joint meeting of the Cement and Quarry sections of the National Safety Council was held at 2 p. m. Tuesday, Sept. 27th at the Stevens Hotel, Chicago. Mr. Frame again was chairman of the Cement Section and as Mr. L. R. Cartwright, chairman of the Quarry Section was not present Mr. Frame took charge of the meeting. The first talk on the program was by W. L. White, general superintendent of the Sandusky Cement Company. This paper was published in full in the September 28th number of Pit and Quarry.

"Fixing accident responsibility," said Mr. White, "is a most serious problem. It calls for a decision which, under any circumstances is hard to make—one which must be carefully studied and only a cool, clear, unbiased opinion should be used in handing it down.

"In fixing responsibility four matters must be considered, viz. the executive or company policies; the plant manager or superintendent; the plant Safety Committee and the individual.

"It is a well known fact that the attitude of the executive is reflected down to the humblist employee. If the plant executive does not believe in safety work but merely tolerates it, the men sooner or later take the same attitude and safety work in such a plant is a total loss.

"The second party on whom responsibility rests is the plant superintendent and in a large measure the success of the entire safety project rests with him. He must be able to put the idea across to his men.

"During the war when we had much negro labor at our plant a negro was loading coal into a screw conveyor. This screw conveyor was guarded with a heavy bar grating, bolted down to the concrete. The plant superintendent was in this department for some little time, principally with the intention of putting across the safety idea to these men, as several serious accidents in screw conveyors had occurred prior to this time. No sooner had the superintendent left the storage than this negro removed the grating, straddled the conveyor and started to shovel in coal. He slipped, fell in the screw, but miraculously had only the flesh and muscles of the calf torn instead of losing his entire leg. While he lay on the stretcher, waiting for the doctor, the superintendent asked him why he did it and he was frank enough to admit that he wanted to hurry his work up and then sit down and rest, which is characteristic of the negro.

"This accident brought the superintendent face to face with fixing the accident responsibility and he felt somewhat guilty himself in that he had been unable to put the safety message across. Needless to say this superintendent was a much better safety man in the future.

"It is a poor practice to close the door after the horse is stolen and the best way to prevent waste of time, trouble and perhaps hard feelings due to placing accident responsibility, is to prevent accidents. This can only be done through increasing effort."

"How Can a Mill With a Perfect Record Keep It Up?" was the title of the next talk by W. H. Weitknecht, superintendent of the Lehigh Portland Cement Company. Mr. Weitknecht said that the best insurance is man insurance and that the proper way to insure a mentally awake worker was to eliminate the fatigue hazard and give each man some personal responsibility in the safety campaign. Planning for the future, especially with regard to known hazards will help a plant to keep up a good safety record, Mr. Weitknecht said.

The nominating committee then put in nomination the following names for officers of the Cement Section for the next year; for chairman, T. F. Halpin of the Marquette Cement Manufacturing Company; for vice-chairman, F. E. Towne; for secretary, A. J. R. Curtis; for chairman of the committee on posters, R. B. Fortune; for chairman of the program committee, Russell Frame, and for chairman of the membership committee, Henry A. Reninger. These officers were all duly elected.

Major Reninger asked if those present would be interested in a meeting devoted to community safety and receiving an affirmative vote the meeting was arranged for later in the evening. Mr. A. J. R. Curtis then read some very interesting statistics on a technical study of cement plant accidents which showed that a great majority of accidents were due to the human factor rather than machinery.

Quarry Section

A meeting of the Quarry Section of the National Safety Council was held on Wednesday morning September 28th at the Stevens Hotel, Chicago. Mr. L. R. Cartwright, vice-president of the Mid-West Crushed Stone Company was chairman.

The opening address was made by Otho M. Graves, president of the National Crushed Stone Association. Mr. Graves said that maximum production could not be secured in any plant until accidents had been reduced to a minimum and that the

industry needed men to whom the outworn phrases such as "business is business" and "caveat emptor" were translated as "no business is good business without safe practices" and "the buyer should be protected by the seller." He said that an analysis of 5000 industrial accidents showed that the hidden costs of these accidents were four times as great as the insurance costs, meaning by hidden costs the time lost, the training of a new employee, damage to machinery, etc. Mr. Graves said that in a questionnaire sent out by the National Crushed Stone Association 60 per cent of the quarries said they were not members of the National Safety Council and 35 per cent said they had never been solicited for membership in any manner. Twenty-seven per cent of the members said they were in the National Safety competition, but 17 per cent of the 73 per cent remaining said their plants were too small to be eligible. Seventy-five per cent of the members of the National Crushed Stone Association said they believed safety should be a major plank in the program of that association. Mr. Graves said that many men in quarry operations are unable to distinguish between the bravery of a hero and bravery which is mere foolhardiness and that many accidents are due to this lack of education. The nominating committee then reported that they had selected the following as officers of the Quarry Section for the ensuing year: D. C. Souder, France Stone Company, Toledo, Ohio, chairman; R. E. Colwell of the U. S. Gypsum Company, Chicago, vice-chairman and J. R. Boyd, secretary of the National Crushed Stone Association, secretary.

Dr. E. M. Parlett, supervisor of health and safety for the Pittsburgh Limestone Company, a subsidiary of the U. S. Steel Company next talked on the subject of "The study of the human element in its relationship to organized accident prevention." He pointed out that men fall into three classes, viz. normal, subnormal and abnormal and that the instinct of self preservation will make the normal man not only shield himself, but others, from accidents. Conservation of forests was undertaken many years ago and then of farm animals and at last, he said, we are coming to realize that the conservation of human beings is important. The medical profession, which has at last succeeded in conquering the plagues of diphtheria, typhoid and other diseases is now giving attention to the fatilities due to external physical violence.

The behavior of man is now being studied and as we find that the average quarry employee is in the moron class we must protect him as we would a child. Dr. Parlett suggested as means for accomplishing this end, physical examinations, instruction in safe practices, education, organizing for mass action such as fire drills, supervision, elimination of fatigue and other welfare work, research, the practical application of the known laws of psychology to racial and other characteristics and discipline.

Dr. Parlette says his company has organized a blasters school and both five and ten year "no accident" clubs. Men who formerly reported accidents which occurred outside the plant as plant accidents have been stopped from this practice by being required to sign a card testifying to the fact that they have had no accidents as they leave work each evening.

Suggestions in safety work which come from the men and which are found to be practical are made into signed orders and prominently bulletined with credit given to the man making the suggestion. This appeal to the individuals pride has kept the interest in safety work at white heat.

The next speaker on the program was Mr. A. Jones of the Indiana Limestone Company who spoke on the subject of "Safe Handling of Rock." This paper was published in full in the September 28th number of Pit and Quarry.

"It has only been in the last two years," said Mr. Jones, "that the quarries of southern Indiana have taken any real interest in safety problems. Possibly the reason why we have accidents in quarries is the same reason why we have automobile accidents. There are men in every walk of life who have accidents and others who do not. If we could find the nature of this inherent difference and educate the hazardous worker so that he would exercise the care of the non-hazardous worker we would have solved our problem.

"In spite of all that we have done at the Indiana Quarries in reducing accidents they still occur. Men have tried to thaw out dynamite on the hearth of the blacksmith shop. Men have used drills to remove the tamping left from a misfire, have drilled too deep and set off the explosive with the usual result. Men have left powder cans open and exposed to sparks. Some individual decides to climb up a pile of rock just blasted out, only to step on and release an overbalanced rock causing a slide which, if not disastrous to himself, may be to others. These are the types of serious hazards which occur in quarries. There are many others, some serious and some less serious, but all working to reduce production and plant efficiency. We now definitely know from our records that accidents can be materially reduced by an organized safety campaign and the plant which does not have this advantage will in the future be at a serious handicap with its competitors."

In starting the discussion of the above talks, A. C. Hewitt, of the American Lime and Stone Co. said that he was very much surprised at the figures given by Mr. Graves to the effect that 35 per cent of the quarries had not been solicited for membership in the Safety Council and he made a motion, which was carried, that the Quarry Section solicit these plants for membership.

T. F. Halpin of the Marquette Cement Company said that every cement plant, totaling 151 plants, was a member of the National Safety Council, being the only industry with 100 per cent representation and he then offered his services as chairman of the Cement Section to help the Quarry Section attain a like record.

L. R. Cartwright of the Mid-West Crushed Stone Company said all of his company's plants were doing well in safety work with the exception of one plant where two members of the Safety Committee had been injured through their own carelessness.

A. Jones of the Indiana Limestone Company said that his company treats employees for home as well as plant accidents, making no distinction therein. The only way to avoid infections, he said, was to require employees to go to the first aid depot for the slightest scratch. R. L. Halpin of Kansas City, Mo., asked if any of the delegates had any authoritative information on the effects of lime dust.

S. V. Eels of the Bessemer Limestone Company said that an investigation in his plant proved that limestone dust was beneficial to tuberculosis and for healing cuts. Mr. A. Jones said they had trouble at his plant on this question with union employees but independent research by medical men had established the fact that limestone dust was not injurious. R. S. Dalmadge of the Ohio Quarries Company said that the human element and not machinery was in most cases responsible for accidents. He said his company puts a guard under channeling machines to prevent employees feet being run over.

Group luncheons were held on Tuesday and Wednesday. The cement section held a dinner on Tuesday evening while the quarry section held one on Wednesday evening. The meetings of both the quarry and cement sections were well attended and the enthusiastic discussions showed a new interest in accident prevention in the cement and quarry industries.

New German Process for Staining Mortar and Concrete

It is reported that a new process for the staining of mortar and concrete has been introduced in Germany. The inventor claims that the process both lowers the costs and improves the quality of the stained material. The usual process of staining mortar and concrete employs certain earth colors and metallic oxides, characterized as "cement colors." The large quantities of the cement color required to stain the cement renders the process costly and tends to lower the strength of the cement or mortar. These disadvantages are claimed to be overcome in the new process in which the mineral colors are ground with certain inorganic salts, either dry or in water solution before they are mixed with the cement or mortar. The addition of the inorganic salts serves a double purpose. The mineral colors take on a more lasting and intense color as a result of the action of the mixed salts in combination with oxygen in the air and other atmospheric influences; also the addition of inorganic salts reduces the quantity of the mineral color to be employed. Another advantage of using inorganic salts is that lesser amounts of mineral colors are required, thus preventing the loss in strength of the mortar and cement.

Plan Third Southwest Road Show

The third annual Southwest Road Show and School is scheduled to be held in the Coliseum at Wichita, Kansas, February 21 to 24 inclusive, 1928. This show is held for the benefit of state, county, township and municipal officers, material producers, contractors, dealers, engineers and all others interested in road building, maintenance and general construction work. Due to the success of the Show in past years the territory has been increased from nine to fourteen states and it is therefore expected that next year's show will bring the largest attendance on record. Exhibitors who show their products at the 1928 show will have many things of interest to pit and quarry operators in the central and southwest territories. The Good Road School will be held under the direct supervision of the Kansas State Highway Commission and the Engineering Department of the Kansas State Agricultural College with the cooperation of the Southwest and Central States and Federal highway engineers, United States Bureau of Public Roads and other organizations interested. The second floor of the exposition building, which has a theatre with a seating capacity of two thousand persons will be used for the Good Roads School.

The show promises to be one of the best held in the Southwest and will undoubtedly attract persons from many states of the Union.

Russia Building Asphalt Roads

Emulating Rome, whose ancient greatness was founded on roads that have withstood the ravages of centuries, the Russian government is now building a network of asphaltic concrete roads similar to the California state highways which have played such an important part in the general upbuilding of this state.

This information was disclosed by George J. Kuhrts, Jr., general manager of the Standard Boiler and Steel Works. Two 6 ton paving plant dryers, manufactured by the Standard company, and two complete Madsen Iron Works portable mixing plants were shipped from Los Angeles recently consigned to the Amtorg Corporation in New York, for reshipment to the Baku district on the Black Sea.

EFFECTIVE, SIMPLE, COMPACT UNIT FOUND IN DES MOINES SAND AND FUEL PLANT

PRODUCING two grades of sand for road building and plastering purposes, respectively, and three grades of crushed stone, the Des Moines Sand and Fuel Company's plant, situated about two miles from the busy Iowa metropolis, has been designed to handle materials with the least possible waste motion and conveying distances.

The company, which is privately owned by E. M. Gray and his son, G. E. Gray, owns a tract of approximately 50 acres on which is located a private lake of about 18 acres. The material pumped from this lake is sometimes so mucky and full of sticks and foreign matter that it would be difficult for the average sand plant to handle it. However, as will later develop in this article, this plant is not an ordinary one.

The material is taken up by a Swintek heavy duty traveling cutter located about 100 feet from shore and is pumped by a 10 inch American Manganese "Amsco" pump belt driven by a 200 h. p. Westinghouse motor through a 10 inch pipe to a 4x12 foot revolving screen grizzly, made locally by the Eagle Iron Works. This distance between the cutter head and the grizzly is about 800 feet, on the average. This grizzly is shaft driven from a 20 h. p. Westinghouse motor, this shaft also driving two sizing screens. The oversize from the grizzly, which consists of all stone 2 inches or over, is dropped to a Good Roads, Ft. Wayne type jaw crusher driven by a 15 h. p. motor, after which it is elevated by Brown Hoist Bucket elevators on 28 foot centers, driven by a 3 h. p. motor to the grizzly and passes through with the other material to two 5x10 foot Brown Hoist revolving screens perforated with ⅛ inch holes. Here it is given a first washing and the sticks and mud removed, the sand and water through the ⅛ inch holes being chuted to a sump. This is also a settling tank, being of concrete about 12 feet square and 8 feet deep. The clean sand being heavier drops to the bottom and is drawn off by an 8 inch pump direct connected to a 150 h. p. General Electric variable speed, slip ring motor. A spillway at the surface

G. E. Gray, General Manager

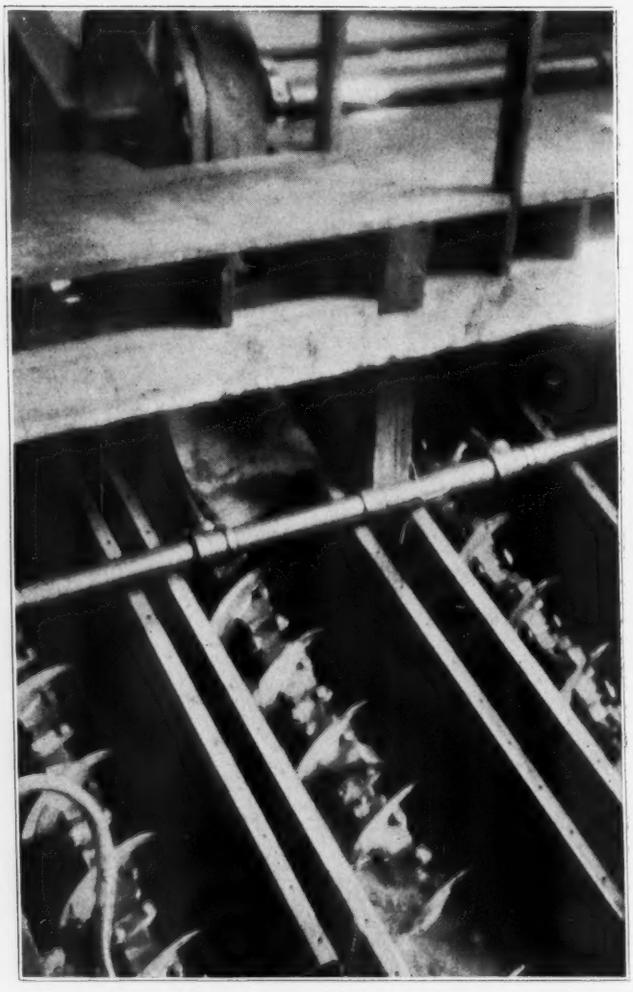
View Showing Concrete Bins, Open Storage Piles and Steel Bins for Truck Loading

Brownhoist Crane for Car Loading

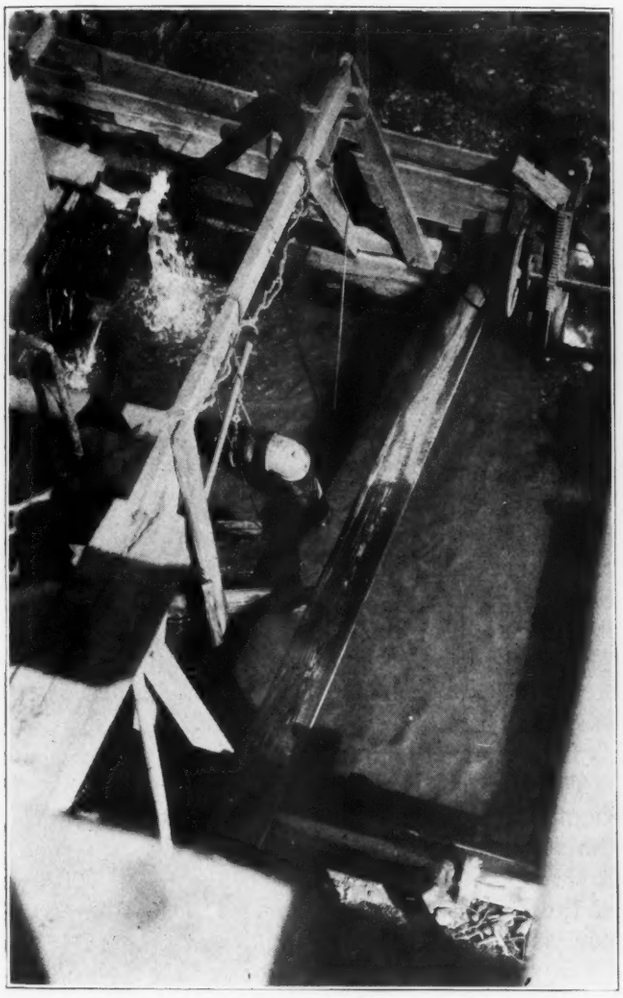
Rigging for Cutter

of the settling tank carries off all foreign matter and muck, which being lighter than the sand can thus be easily eliminated. The clean sand is pumped 50 feet to the lower end of the trestle-work which carries the belt conveyor for crushed stone and on this support is piped 70 feet vertically by 300 feet horizontally at an angle of about 30 degrees to a sand flume about 500 feet long where it passes through Link Belt conical sand separators to open storage piles. Two grades of sand are produced, that from $\frac{1}{8}$ inch down being sold as brick, plaster and engine sand and that from num-

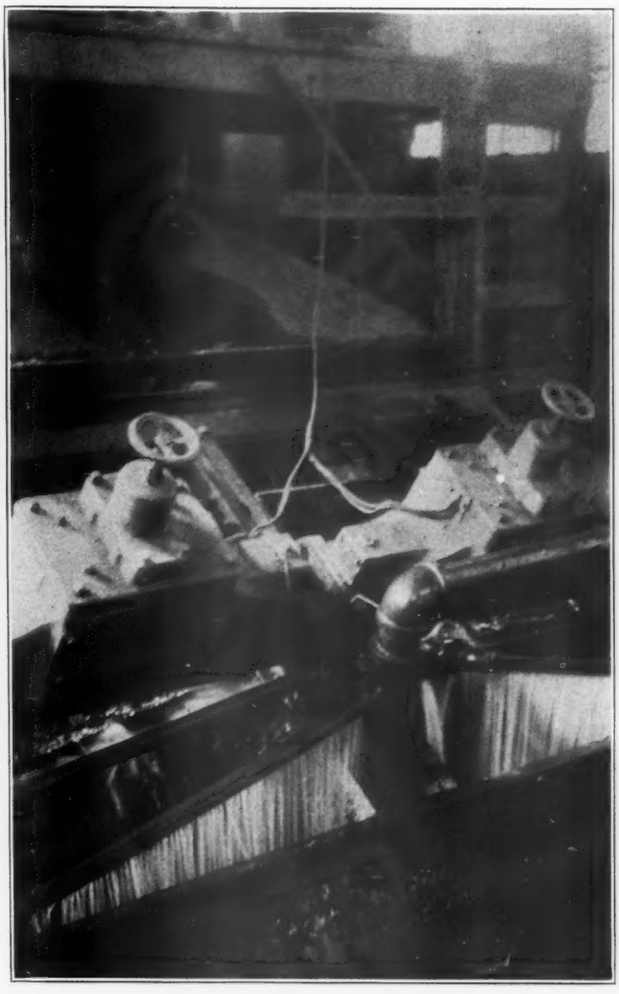
Crushing Plant. Note Character of Material Removed, in Foreground



Screw Type Sand Washers



Sump, Showing Overflow Gate at Top Right

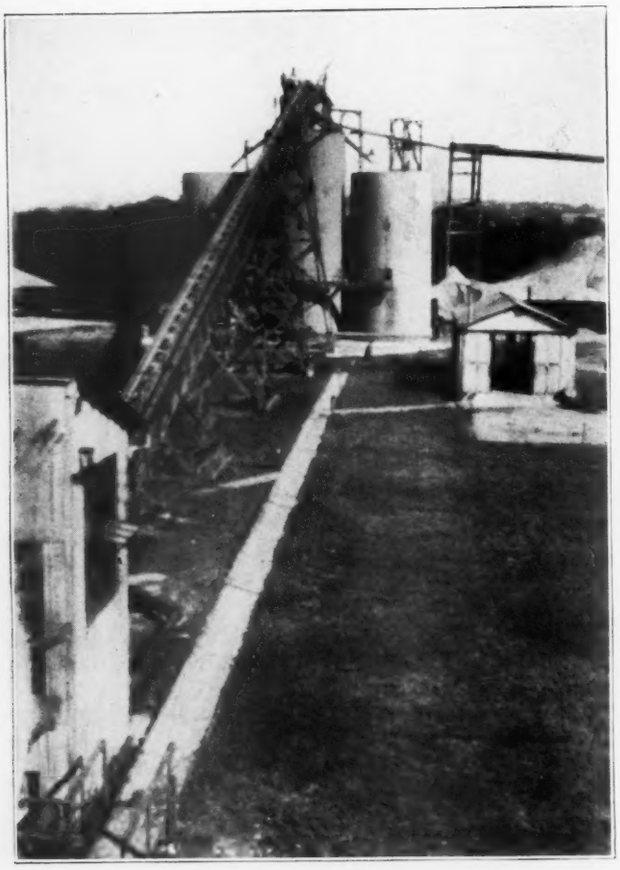


Sizing Screens and Washers

ber 4 down being sold as a highway construction sand. Open storage space available is adequate to store 100 fifty ton carloads of each grade of sand. For the retail truck business, the two grades of sand are picked up by a number 2 Brown Hoist Electric creeper crane equipped with a one yard bucket on a 40 foot boom and loaded into two steel bins of about 80 tons capacity each. These bins which are of the company's own design and which were built locally are placed immediately over a wide concrete paving and load from the bottom through a chute directly into the trucks. This enables the company to furnish dry sand to the retail trade at all times which would not be the case if they were compelled to load trucks direct from the open storage piles. For carload business, however, the sand is loaded directly from the open storage piles by the Brownhoist crane. This electric crane is especially handy in winter as it can be put to work instantly without the requirement of getting up steam and as the company enjoys a low power cost, averaging about 1.7 cents per k.w., this electric crane has proven a good investment.

The material over 1/8 inch rejected by the two revolving screens passes to a hopper and then is picked up by a 28 foot centers Brownhoist bucket elevator driven by a 15 h. p. motor which delivers it to a 4 foot, type 39 Hummer screen in the screen house. This takes out everything over 3/4 inch which is by-passed to a picking chute where the larger stones are picked out by hand, this being a waste product, and the remainder of the material passes to one of four Eagle washers. A 35 h. p. General Electric motor drives a shaft which drives all the machinery in the screen house. From the washer the stone passes through a 3/4 inch screen and advances to an 8 foot, double-deck Hummer screen which sizes the material into 1/8 inch to 5/16 inch and 1/4 inch to 3/4 inch. These sizes then pass into three Eagle washers, the 1/4 inch to 3/4 inch size going into two of the washers and the 1/8 inch to 5/16 inch size going into one of the washers. These washers take all the sticks, coal and other foreign matter out and deliver a clean product into the three holding or temporary storage bins. These bins have a capacity of about 14 cubic yards each or sufficient for a 22 minute run when the plant is operating at full load.

From these bins the one-man operator of the screen house is able, through a series of lever shifted mechanisms, to deliver any desired size of stone from the bins to the belt conveyor which carries the stone to the concrete storage silos. This belt conveyor is 18 inches wide on 264 foot centers



Conveyor Belt to Concrete Storage Bins

and is driven by a 20 h. p. motor. One size of stone is run at a time and taken up the belt conveyor to the three monolithic concrete silos, two of which are 20 feet in diameter by 40 feet in height and one 20 feet in diameter by 50 feet in height. Car loading is done on one side of these silos and truck loading on the other side. The three sizes of stone produced are "highway specification"—from ¼ inch to 2 inch; "reinforced concrete specification"—from ¼ inch to ¾ inch, and "pea gravel"—from ⅛ to 5/16 inch. The entire production of the plant, which is about 30 carloads per day, is sold in Des Moines and the Southwestern part of Iowa.

A remarkable feature of this plant is the one-man remote control at the screen house. This man has a view of the entire operation from cutter head to storage silos. By an electric horn he can signal the cutter operator. He can control the product as it passes the grizzly, crusher and screen and he is, of course, in direct control of the screening and washing operations in the screen house. He has remote control of the motor operating the belt conveyor to the concrete storage silos and by the direct lever-shifting mechanism at the temporary holding bins can place any size of product on the belt that he desires. The plant operates night and day and is well illuminated to take care of night operations. Moreover, it is constructed throughout on structures of a more permanent nature than is ordinarily found in this kind of plant.

New Paving Material for England

Experiments extending over many years have been made to discover a road surface for London thoroughfares that would not have the disadvantages of the two systems now most generally used—wood blocks and asphalt. Three essential qualities have been looked for: A nonskid material, the elimination of vibration, and a system that will render the surface, as it is generally known, almost indestructible. Experiments made in various parts of London, under the supervision of borough engineers and also by the ministry of transport, have resulted in the finding of a new surface material that may lead to a new era in road constructions.

The new material is synthetic rubber, of which the chief ingredients are peat and bitumen. The blocks are made under pressure and are elastic. It is claimed that they are nonskid, that vibration is eliminated, and that the surface is waterproof. The blocks have a smooth surface and are slightly larger than wood blocks. They are less deep, however, and this allows a sort of lining to be laid down between them and the concrete foundations.

The surface was first laid as an experiment 18 months ago on a part of the Uxbridge Road, under the supervision of the Middlesex County Council. It is estimated that since then about 9,000,000 tons of the traffic have passed over it. Another small portion of the Uxbridge Road was treated in the same manner nine months ago; and six months ago, under the supervision of the Kensington (London) authorities, a part of a road within their jurisdiction was laid in the same way.

Peat is plentiful through the British Isles, the bitumen comes from Trinidad, and all the other ingredients are found either in Great Britain or the Empire, so that the cost of making the new blocks is comparatively small.

A leading expert on road construction in England has reported that the new blocks had proved the most suitable material for road construction yet brought to his notice. Their use is, of course, in the experimental stage only; but if the ultimate results should prove satisfactory there will be no occasion in the future as there is now to break up existing foundations before thoroughfares can be relaid and thereby entail the closing of important main traffic arteries for many months at a time, dislocate traffic through its necessary diversion, and lose trade to businesses situated in the areas under repair. (Commerce Reports, September 26, 1927).

Canadian Good Roads Convention

The Canadian Good Roads Association will hold its convention at Niagara Falls, Ontario, on September 27th and 28th. It is expected that this will be the greatest good roads assembly in the history of the Dominion of Canada.

THE HOME OF WOOD BURNED LIME

By F. A. Westbrook

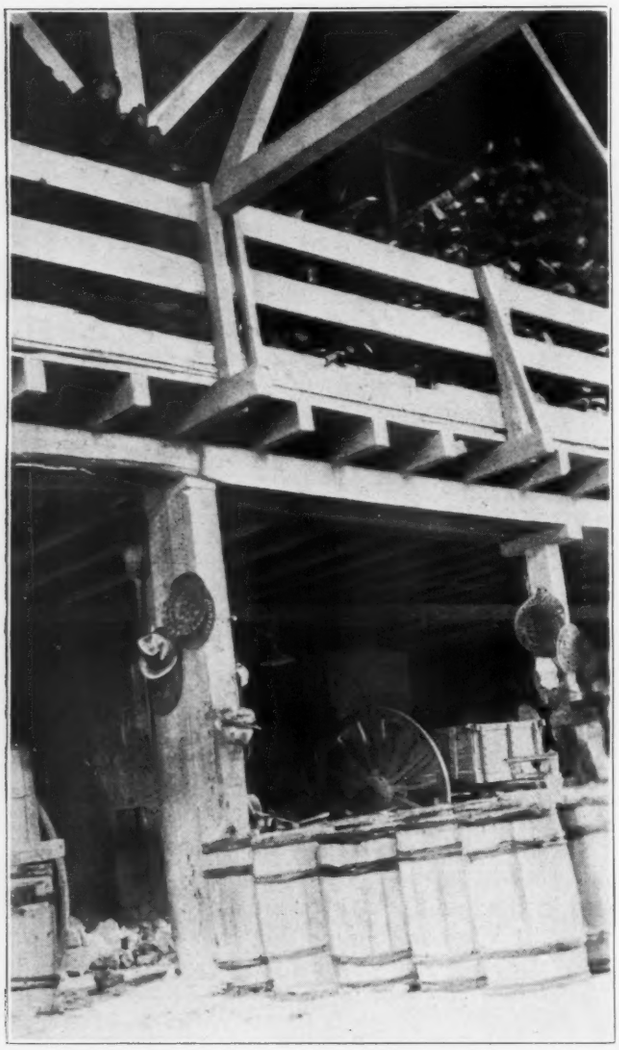
IN MOTORING along the coast of Maine the traveler cannot help being impressed and perhaps a little thrilled by the beautiful towns through which he passes. Many of them in the region of Portland are busy and prosperous because of a wide variety of manufacturing activities, but after progressing "down east" beyond Bath they are smaller and rather sleepy little places. The beautiful elm bordered streets and quiet, dignified homes of pretentious size and pleasing architecture speak of a prosperity of which there is now no sign in the way of factories or farms. As a matter of fact these villages, such as Wiscasset, Demariscotta, Waldoboro, Thomaston, took on their present appearance during the days when this was the great shipbuilding center of the country. Some of the homes were built during the first decade or two of the nineteenth century but a great many of them date from the period between 1850 and 1860 when shipping was at its height, just before the steamer began seriously to displace the sailing ship.

However these towns were settled much earlier than this. Take Thomaston, for instance. The British explorer Waymouth anchored off the bay now known as Georges River and sent a party in small boats up the river to the present site of Thomaston in 1605, fifteen years before the Pilgrims landed at Plymouth. They set up a cross to prove that they had been there and to establish the claim of England to sovereignty over the land; and the interesting thing is that this cross was within a few rods of the lime kilns now operated by J. A. Creighton & Co.

Hundred Year Old Office Building

The burning of lime was started here by the first Scotch-Irish settlers who came between 1730 and 1735 and it has been carried on ever since. These early settlers were farmers and they had been in the habit of using lime on their land in the old country, so as soon as they arrived in the new world they naturally looked for limestone to burn and as this is a limestone country they found it. To this day the grass grown remains of kilns and minature quarries may be seen by any who take

One of the Abandoned Quarries

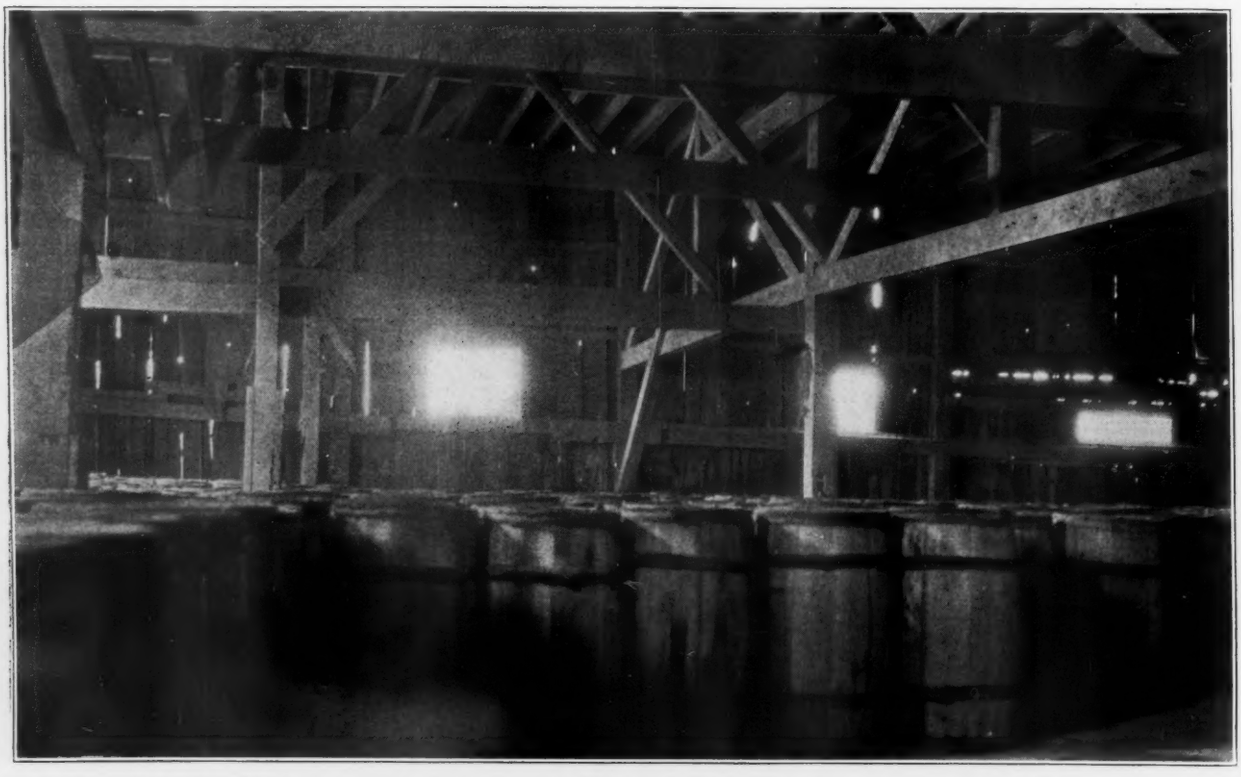


Part of Wood Storage

the trouble to look for them along the upper reaches of the Georges River. Among these first settlers was David Creighton, the great-great grandfather of the present John and Charles Creighton who now operate the lime kilns. David Creighton came to a tragic and untimely end when he was killed and scalped by Indians about 1750.

Fort Waymouth was built about this time between the present lime kilns and the office of J. A. Creighton and Company, a building which is itself a hundred years old or more, but does not look it so far as upkeep is concerned. The object of the fort was to provide a place of refuge for the settlers when the Indians started on the war path during the French and Indian War. Nothing of it now remains except the old well which is still there under a pile of cord wood.

Lime burning as an industry was started some time between the end of the Revolution and 1800 by General Knox, Washington's Secretary of War. He built a fine mansion on the point near the Creighton office and although this is no longer in existence the present Thomaston railroad station of the Maine Central Railroad is the building erected by General Knox for his servants' quarters.



Bottom—Barreled Lime Waiting for Shipment in Room Adjacent to Fort Wharf. Upper Left—Drawing Floor Showing Wood Storage

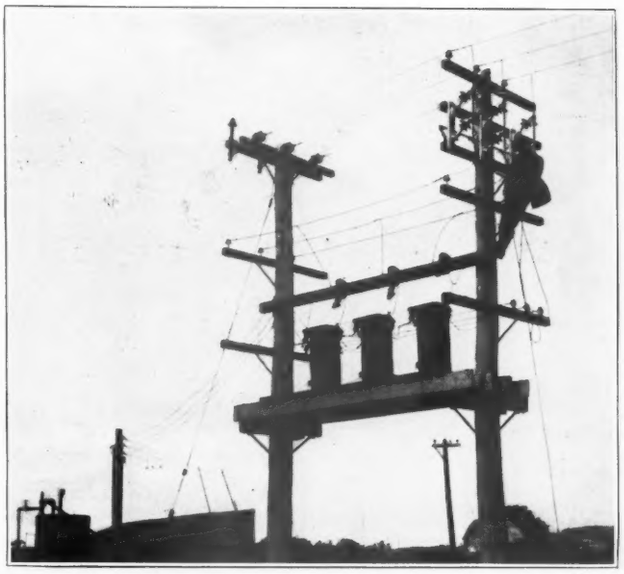
In fact the Creighton's present wharf alongside their kilns and from which they now ship barrelled wood burned lime by water was built by General Knox before 1800. It is still called the Fort Wharf because of its proximity to the old Waymouth Fort.

When Thomaston became a shipbuilding town lime was frequently taken on as ballast for ships built here on their first trip to New Orleans where they usually went for a cargo of cotton for export to Europe and it was not unusual for sailing vessels to call here especially for a cargo of burned lime to be delivered to points along our Atlantic coast.

Thus we see that not only does the lime industry in this country enjoy the dignity of a ripe old age but that it played a very important part in the early development of a much beloved part of the country. It was from here also that the important lime industry of today spread to Rockland, which was formerly a part of the town of Thomaston and now adjoins it on the east.

The firm of J. A. Creighton and Company was started in 1856 by the father of the present owners. The quarries were located in the eastern part of the town, about two miles from the kilns on the shore front, as they are today. Of course during that time numerous openings have been made and abandoned. The company owns extensive limestone deposits and the policy has been followed consistently of not going deeper than it is possible to haul out loaded trucks with horses. Of course this practice can be modified by installing derricks and hoisting machinery and probably it will be some time.

In fact at the present time a new opening is being made. Of course several modern tools are now used such as Ingersoll-Rand jack hammers for drilling (one of them has given six years service and is still in good condition) and a Cameron centrifugal pump driven by a Westinghouse motor to keep the quarry dry. Both pump and motor are mounted on a drag which can be pulled out of harm's way when it is desired to blast. Forty per cent Du Pont dynamite is used for the latter. An Ingersoll-Rand compressor driven by a General Electric motor has been installed in a building of its own. The outdoor transformer substation to supply electrical power is shown in one of the illustrations.



New Outdoor Transformer

View of New Quarry Showing the Pump

Elevated Approach to Top of Kiln

Spruce and fir are burned in the kilns, of which there are nine. The supply of wood is obtained in part from the farmers in the neighborhood and in part from the company's own wood lots. The burned lime itself is shipped in barrels made by hand in a building on the site of the Waymouth cross. A railroad siding extends alongside the kiln sheds so that shipments may be made by rail as well as by boats moored to the historic Fort Wharf built by General Knox over one hundred and twenty-five years ago. On the outside of the office building is a sign which says, "The Home of Wood Burned Lime." Without a doubt what this sign sets forth is true and it cannot be viewed without a thrill of interest by anyone connected even in an editorial capacity with the industry.

Gypsum Deposits in Germany

For the utilization of the extensive deposits of gypsum and anhydrite in Germany on the Moselle as a source of sulphuric acid, various methods are proposed, among which is the Bambach process effecting the decomposition of gypsum at 1,400 degrees Celcius by means of the surface combustion of producer gas with air on the gypsum. The air may be shut off at intervals, allowing the alternate formation and decomposition of calcium sulphide. According to a chemist named Bassett, the gypsum is heated in a rotary furnace with clay and coal, steam being blown in and cement produced as a residue. The most important process is the Bayer, belonging to the I. G., which produces nearly 3,000 tons of sulphur trioxide monthly. This process uses powdered anhydrite and waste calcium sulphate, mixed with powdered shale and coke, and fired with powdered coal in rotary cement kilns, in a slightly oxidizing atmosphere. The I. G. has also tried a process in which gypsum is allowed to interact with magnesia and carbon dioxide, whereby it is partly converted into magnesium sulphate. Another process replaces the magnesium by ammonia. However, the last two processes leave calcium carbonate which has been difficult to dispose of.

New German Mixed Fertilizers

In August, 1927, the German Nitrogen Syndicate put on the local market another complete chemically combined fertilizer, Nitrophoska III, in addition to its two previous mixtures that were announced in December, 1926. The new fertilizer presents another highly concentrated fertilizer substance containing 16.5 per cent nitrogen, 16.5 per cent phosphoric acid, of which 15.2 per cent is water soluble and 1.3 per cent citrate-soluble, and 20 per cent pure potash. Thus, it is characterized by a comparatively high percentage of phosphoric acid. The domestic price is 26.70 marks per 100 kilos product delivered anywhere within Germany. Nitrophoska I is priced at 26 marks per 100 kilos and Nitrophoska II, at 24.50 marks, Nitrophoska I has 17 per cent nitrogen, 12.7 per cent phosphoric acid, and 21.1 per cent pure potash. Nitrophoska II has 14.7 per cent nitrogen, 11.1 per cent phosphoric acid and 25.6 per cent potash. It is thus observed that while Nitrophoska I has 50.8 per cent and Nitrophoska II, 51.4 per cent, Nitrophoska III has 53 per cent available plant food.

South Australia Approves Big Road Plan

The program for road construction in the State of South Australia for current fiscal year (July 1, 1927-June 30, 1928), under the terms of the Commonwealth grant, has been approved. The amount available for the year is £399,000, of which £228,000 is to be callocated from federal funds, the balance, £171,000 contributed by the state. Of this sum £93,850 is to be allotted to the development of main roads, £96,500 to trunk roads, £189,000 to arteral roads, £7,800 to supervision, £9,000 to sinking fund, leaving a balance of £2,850, as yet unallotted. The construction of trunk and arterial roads will be either bituminous concrete or bituminous penetration. The amount applicable to main roads will be used chiefly in improving and extending existing roads.

VALUES OF ACCIDENT PREVENTION

By Otho M. Graves

President, National Crushed Stone Association

Vice-president and General Manager, The General Crushed Stone Company*

SINCE the time when our sturdy Puritan forefathers landed on Plymouth Rock and fought valiantly and successfully the elements and hostile Indians to establish a foothold and a living place in the land they named New England, and when under fairer skies and on more fertile soil the cavaliers of Old England established their colonies in what is now Virginia, this nation has flourished and prospered. With natural resources of almost unbelievable richness and seemingly unlimited in quantity, with a population growing by leaps and bounds, not only through a prolific birth rate, but enlarged steadily and constantly by immigration from the countries of the Old World, the tide of progress has continued to sweep westward. Blessed with material prosperity and success, it has seemed as though the thread of our destiny has been woven into the fabric of world affairs by the hand of a fate graciously inclined to our needs and welfare, forming a part of that design known only to the Master Weaver. Nor is this prosperity confined to any small and fortunate class of our population; it is shared and enjoyed by the mass of our citizenry. True it be that some fortunes have been amassed which would awaken the envy of a Croesus or Nero, thrown into strong relief by the dark shadows of poverty among a few as abject and misery-stricken as were the lower classes of France immediately preceding the French Revolution. But these extremes present with us are limited in number and are the result of circumstance and opportunity seized by some and ignored by others, whether their failure be due to ignorance, laziness, drunkenness, inability or any of the other causes operating to prevent a successful grasping of the potential opportunities that confront us all in this nation, differing thereby fundamentally from the poverty of the serfs held in political and economic subjugation by a ruling class fattening in idleness on their labor. We have, as Gladstone pertinently pointed out, the froth and the dregs, but thank God for the good beer in between. In view of our living in these days when prohibition has come and largely gone, the thought of the glass of beer must be abandoned, though with reluctance.

With a continent stretching to the westward of the early settlers on the eastern shores, the western limit of which was not even conceived by them, it is not strange that the generations following came to believe that our natural resources were unlimited in extent. It is only in recent years when we have spanned this three thousand miles of territory and planted cities on the Pacific Coast rivaling in magnificence and in population those of the East that we have come to realize that these natural resources must be conserved and guarded with jealous care if we are to continue to thrive and prosper. It is not so long ago when the phrases "conservation of forests," "of water power," "of coal," "ore" and the other gifts of a beneficent

Otho M. Graves

deity sounded strangely in our ears. We have come now to accept such economy as a matter of course; and yet we have largely continued to overlook the conservation of the greatest of all material, mankind itself. Of all the material with which we have to work, there is none so vitally important nor so fascinating as the human.

Over its coffee cups the world reads the morning newspaper with horrified amazement as fatality after fatality is reported among the aviators daring the trans-oceanic flights and asks that laws be passed prohibiting such a useless sacrifice of life, and yet complacently we go our way without giving thought that last year in the United States alone approximately 180,000 persons suffered accidental death and 7,500,000 endured casualties that did not result fatally. These daring aviators risking their lives in the cause of science and human progress bear that relation to this age as did Columbus, Magellan, De Soto and others of their courageous faith to an era past and gone. Our pride in the achievement responds with a thrill to the accomplishment of such men, but we can see nothing more in industrial accidents than sordid carelessness on the part of the employee or almost

*Presented Before the Quarry Section, National Safety Council, September 28, 1927.

criminal lack of interest on the part of the employer, with possible resultant poverty, misery and mental anguish to the family of the injured one.

A relatively new thought is manifestly permeating industrial activity—the recognition of the interdependence of employer and employee, a relationship which now approaches economic equality. We are beginning to recognize beyond a mere lip statement to that effect that the employer prospers in direct ratio to the prosperity of his employees. Industry is demanding a new type of executive, one who not only intimately knows the processes of manufacture, but who also sympathetically visions and understands the problems which confront his men, one who while directing and governing creates in those associated with him enthusiastic cooperation; in other words, a leader, not a boss, one whose integrity and qualities of judicial fairness and human sympathy awakens and holds the confidence of his men. To such an executive the physical safety of his men is of paramount importance. He is motivated in safeguarding them in their employment no less by reason of their economic value, impaired as it is by lost time from any cause, than by his humanitarian interest in their welfare and contentment of mind. A contented worker is obviously of more value than one discontented and disgruntled, whether his disturbed state of mind comes from a belief that he is underpaid, unappreciated or unduly exposed to unnecessary hazards. We have outgrown the moral crutches evidenced by such phrases as "Business is business," "Honesty is the best policy," and "Caveat emptor." We now clearly perceive that business is good business only when it is conducted along sound, ethical lines. We are honest because we know that we should be, and the values of honesty come as by-products. The buyer is not expected to beware, but is protected, and so should be the worker.

Is the time and money required to promote accident prevention in any particular plant economically justifiable? The answer to this question is in the handwriting on the wall, with abundant proof of an affirmative answer to the query in the experience of our largest industries. The evidence is overwhelming that a safe plant is an efficient one, and conversely, an efficient plant is a safe one. It is being constantly demonstrated that by giving due attention to accident prevention, insurance costs, however carried, are lowered; and, moreover, production is correspondingly increased.

The Committee on Safety and Production of the American Engineering Council has just completed its study of the relationship between industrial safety and production. Some of its conclusions, after the most exhaustive and thorough study ever given to this subject, confirm the beliefs held by some of us and are startling to those who do not share them. There is detailed material in the report of the committee to support the statement that maximum productivity is dependent upon the reduction of accidents to an irreducible minimum, and that there is such an intimate relationship between safety and production that it is impossible for a plant to continue to increase in productivity unless it reduces at the same time its accident rates.

Not so long ago a well known producer of a mined material was quoted as saying that he would not sacrifice production for the sake of reducing accidents in his mines. Such an attitude would be humorously paradoxical were it not tragic. In discussing the incident the memory whimsically came to mind of an old negro who said that on his farm in Southern Georgia he used to raise horses, black horses and white horses, but that he had to give up raising black horses because they ate more than did the white horses. When asked why this was so, he said, "Ah can't exactly account fo it lessin it is that ah had mo black hosses than ah had white hosses." The logic of the manufacturer and of the old negro is equally unconvincing to the enlightened executive. It seems almost self-obvious that a clean, neat and safe plant, factory or mine in which the employees contentedly work under conditions as pleasant as the circumstances of the work may permit is necessarily more efficient and richer in productivity than one of which the opposite is true.

Though it is generally recognized that a reduction in the number and severity of accidents is reflected in lower insurance costs, however the insurance be carried, this is not the only nor even the largest financial saving. The Travelers Insurance Company of Hartford analyzed five thousand specific accident reports drawn at random from the claim files of that Company, disclosing the almost amazing fact that the "hidden" cost of accidents is four times the direct or insurable cost. In this item of "hidden" costs such factors were considered, weighed and estimated as lost time of injured employee, time lost by other employees who stop work out of curiosity or sympathy to render assistance, time lost by foremen and superintendents in assisting the injured one, preparing accident report, attending hearings before industrial commissions, injury to machinery or property as the result of the accident, interference with production, the less effective work of the man replacing the one injured and other factors which suggest themselves but are too numerous to mention. While this ratio of the hidden cost to the insurance cost may not be four to one, as analysis of these five thousand cases would indicate, it is at least something to one, and that something is too much. It is reasonable to believe that intelligent and organized effort to prevent accidents, both as to number and severity, results in lower insurance costs, even greater reduction in the hidden

cost, difficult to estimate, and increased plant efficiency due in part to the improved morale of the worker. But for such endeavor there is yet another reason, either stronger or weaker, dependent upon one's ethical conceptions, and that is the obligation resting upon each of us to do his part to prevent needless suffering and privation.

It is not the intent of this discussion to enter into the various phases of the relation of employer to employee, nor to consider the several factors tending to produce that harmonious and sympathetic accord which alone can develop the fullest potentialities of any industry. That a human, intelligent and sympathetic interest on the part of the executive of any business is a factor in creating a responsive spirit on the part of the other workers must be admitted. While the paternalistic attitude may be resented, the kindly personal interest of the executive makes a direct appeal to the heart and head of the rank and file of labor. Assuming then that accident prevention is worth while from the several points of view upon which we have but lightly touched, there remains only to consider briefly ways and means for accomplishing the desired purpose.

With the thought that it would be both interesting and illuminating to ascertain the attitude of mind of quarry producers throughout the country as to accident prevention, a questionnaire was submitted recently to the members of the National Crushed Stone Association inquiring as to certain phases of this work as conducted by them. The response was generous and prompt. Certain of the information received in that manner seems sufficiently interesting as to be worthy of comment.

Sixty per cent stated they were not members of the National Safety Council, and of the remaining 40 per cent holding membership, the average life of the membership is three years. The nonmembers were asked to state their reasons for not joining. Sixteen per cent replied that they did not believe membership in the Council would sufficiently assist in plant safety work to warrant their joining. The membership of 35 per cent has not been solicited in any manner. The literature concerning the value of membership and the work of the Council has not been sufficiently interesting or appealing to obtain the membership of 7 per cent. The other reasons were scattered, although tending toward an indication of unfamiliarity with the aims and purposes of the Council.

In reply to the question if membership in the National Safety Council was of value and if so, in what ways, such statements were received as—"It is worth while being associated with others in the safety movement," "Stimulates interest in safety and keeps one informed as to accident prevention," "In securing reliable data and information as to safe practices, as well as assistance personally rendered by safety officials," "Through safety posters and magazines."

It may be concluded from these replies that crushed stone producers to a much greater extent should hold membership in the National Safety Council, and a fair inference is set up that the responsibility for the present low percentage of membership must be shared in part, at least, by the Council itself, due to the fact that the membership of so large a percentage has not been solicited in any manner. While it is not our intention to presume to suggest methods to the Council, it is commonly recognized that personal solicitation is far more effective than correspondence; but every member of this industry should be invited by letter at least to join the Council, even if at present personal solicitation is not feasible.

An even lower percentage of our membership is enrolled in the National Safety Competition, namely, 27 per cent. Of the 73 per cent not enrolled, some of the reasons are as follows: Negligence, 10 per cent; do not believe that entry in the Competition would be of assistance, 14 per cent; operations too small, 17 per cent. Other scattered reasons, each having a low percentage, are: Too much clerical work entailed; not familiar with it; didn't know there was such a contest; safety organization too young to compete with credit; intend to join next year; not located in the United States.

As a respectful suggestion to those conducting the National Safety Competition, it is worth consideration, in view of so high a percentage reporting their plants are not sufficiently large to be eligible, that it might be well to lower the requirements in this regard, as accidents occur in small plants as well as in large ones, and also possibly to render the Canadian producers eligible, as there are a number of members of the National Crushed Stone Association located in Canada.

Of those entered in the Competition, all replied that they had noticed increased interest in accident prevention as the result of the competitive spirit aroused in employees as the result of the competition.

In reply to the question "Do you believe that accident prevention and insurance should be made a major issue in the work of the National Crushed Stone Association?" 75 per cent replied affirmatively, commenting somewhat as follows: National Crushed Stone Association can put this across with quarry producers better than can the National Safety Council; believe the N. C. S. A. at next convention should adopt vigorous policy as to accident prevention; believe that N. C. S. A. should take hold of this issue and put it over in same thorough manner in which other Association matters have been handled.

The 25 per cent which are accredited with replying in the negative modify their vote by such com-

ment as follows: Accident prevention only, omitting any reference to insurance rates; not necessarily a major issue, but given an important place in the affairs of the Association.

One producer who voted "no" replied that with the Associated General Contractors, the United States Bureau of Mines, the various insurance companies, the several state bureaus, the National Safety Council and other bodies all working on accident prevention, the subject is becoming overemphasized and should not be handled by the Association. It is safe to conclude that there is an overwhelming preponderance of opinion in the crushed stone industry favoring the Association making accident prevention one of the major issues of Association affairs.

The pamphlet on "Safety Practices for Quarrying" prepared jointly by the Quarry Section of the National Safety Council and the Committee on Welfare and Safety of the National Crushed Stone Association has been of benefit to 75 per cent of those replying to the questionnaire. Ten per cent stated they had received no benefit and 15 per cent replied that they had not received a copy. There is a correlation of thought between the 15 per cent of the crushed stone industry not receiving a copy of this pamphlet and the membership in the Safety Council of 17 per cent not having been solicited. Both of these conditions should be promptly rectified.

The request to "Describe briefly the manner in which safety matters are handled throughout your organization" received elaborate reply, into which it is hardly feasible to enter into detail. It is apparent, however, that those plants which have an intelligently planned and orderly operating safety organization have shown the greatest decrease in both the number and severity of accidents. Far too many replied in an indifferent, hazy manner, such as—"Believe in it myself and tell all of my men to be careful," "Insist that any man who isn't careful be fired," "Keep machinery in good order and expect men to handle it properly" etc. One executive operating only one plant goes so far as to state that he meets personally once a day with all of his employees and talks caution. If this is actually done it should achieve splendid results, but I am somewhat reminded of three women who were talking together, one of whom said, "In all the fifteen years of my married life my husband has not said a single cross word to me." The second women replied, "My, I wish I could say that." The third one said, "Well, why don't you. She did."

It was also requested that the results of such accident work as is conducted be noted as to the number of accidents, the severity of accidents, the decrease in insurance rates and the improved morale of employees. Practically all of those who give any attention whatsoever to accident prevention, whether in a hit-or-miss manner or by orderly planning, reported that the spirit and morale of the employees was improved. The decrease in the severity of accidents and the number of accidents, as well as the decrease in insurance rates is more noticeable in the case of those companies which devote the most time and effort to accident prevention. Naturally this would be expected to be true and is merely confirmation of common opinion.

As to the chief difficulties encountered in conducting successful and effective accident prevention work, 7 per cent replied, "Lack of interest on the part of the employees" and 11 per cent, "The difficulty of overcoming characteristic carelessness of workers." Smaller percentages stated, "Getting the men to believe that we do not want them to get hurt even though we are insured" and "The difficulty of impressing upon superintendents and foremen that accidents are costly." In the case of 9 per cent the chief difficulty was the failure to secure proper cooperation from employees. This is a frank admission, but I am inclined to feel that the responsibility is the employer's rather than the employee's. Several replied that negro labor is indifferent to such efforts in their behalf, as compensation for ten days for small cuts or bruises is extremely attractive. Those who have had experience in employing negro labor will recognize the truth of this observation.

Though it would seem that the answer to the last question of the questionnaire should be obvious, namely, "Do you conduct your accident prevention work from humanitarian motives or in order to reduce insurance rates, or both?" 18 per cent replied, "From humanitarian motives only," the remaining 82 per cent stating that both were considerations. As a matter of fact, a third reason could have been included in this question, namely, "Or for the purpose of increasing plant production?" This was not done because of my belief that the acceptance of the quarrying industry in general of the value of accident prevention work is not sufficiently advanced to readily understand and interpret such a suggested reason. It is highly probable that we do not place sufficient emphasis upon the fact that a safe plant is an efficient plant and that maximum production cannot be obtained without reducing preventable accidents to a minimum.

In reducing the number of preventable accidents, as in any other human activity, orderly planned, intelligent effort results in greater accomplishment than loose, slipshod, hit-or-miss methods. It is far from adequate for the manager or chief executive to earnestly desire to reduce accidents with a cautionary word or two every now and again to the employees as to being careful. In the crushed stone industry we have but to compare the latter type of effort to that of those plants in which accident prevention is a highly organized activity to

realize the value that lies therein. Those members of the National Crushed Stone Association entered in 1925 and 1926 in the National Safety Competition have shown a marked improvement in the latter year over the former. In 1925 the accident rate of those plants entered in the Competition was 6.7 days lost per thousand man hours of exposure as against 6.0 in 1926, and an accident frequency rate per million man hours of 61 in 1925 as against 41 in 1926. This indicates an improvement of 10 per cent in the accident severity rate and 33 per cent in the accident frequency rate. These figures relate to 38 quarries in 1925 and 37 in 1926 and are furnished through the courtesy of Mr. Adams, Supervising Statistician of the Accident Statistics Section of the Bureau of Mines. It is to be regretted that the number of quarries entered did not show marked increase in 1926 over 1925.

Improvement equally encouraging and gratifying has been made by those quarries holding membership in the National Safety Council. In fact it is largely true that practically all quarries entered in the National Safety Competition are members of the National Safety Council.

An analysis of the questionnaire submitted to the quarry industry tends to confirm another conclusion of the Committee on Safety and Production of the American Engineering Council, previously referred to—that the accident and production performance of the best plants in each industry clearly shows that tremendous improvements can be achieved by the remaining plants in each industry. As a corollary, it might be stated with equal truth that the accident and production performance of one industry should encourage other industries to achieve similarly successful results.

The experience of the Portland Cement Association in the reduction of accidents is inspiringly encouraging. In June of this year 164 cement plants employing 45,000 workers participated in a no-accident drive. It is almost amazing to know that accidents dropped 75 per cent during this month as compared with June of a year ago. During the June drive of this year 50 lost time accidents occurred as against 192 during the same period last year. Only one man lost his life in June of this year as compared with six in June of 1926. To endeavor to explain such a marked improvement in corresponding months of two succeeding years as a mere coincident is futile and absurd. Such improvement can only be attributed to the intensive drive of the Cement Association to reduce accidents.

In other industries almost equally great improvement can be shown over periods of intensive accident prevention work as compared to similar periods during which no such campaign was in progress. For the sake of humanity in general and a lowering of production costs, it is encouraging to realize that various industries, through their national associations, are giving increasing attention to the value of this work. The Associated General Contractors of America, alert as they are to improved methods of construction and lowering of costs, are, through their association, entering intelligently into this worth while field.

In the transmutation of an unsafe plant or factory to a safe and consequently more efficient one, certain fundamental principles must be followed, however much the detail of their execution be varied. First, the responsible executive must recognize the several values of accident prevention effort and conceive the intention of improving conditions. Second, his recognition of such values must be transmitted throughout the organization until every man is reached. Third, the formation of a general safety committee operating through local plant committees. Fourth, the education of the employee, however tactfully it may be disguised or through whatever means it be accomplished. Fifth, through mechanical and engineering means the diminishing of all hazards and the total elimination of some.

The human spirit is adventurous; it seeks new experiences, new sensations, gropes its way unflinchingly into unknown territory, both mentally and physically. The progress of civilization has largely been due to those adventurous spirits who have dared unknown dangers to blaze the way that later generations may follow in safety. It is not unnatural to believe that in many instances the lack of care and caution of the workman is attributable to this willingness to face danger and a desire to more quickly and effectively serve the ends of his employer, whom he may like, respect and admire. He must be taught to discriminate between the bravery of the hero, courageous without stint for a worthy cause, and the unnecessary exposure to danger which may be easily avoided with proper care and caution, and that in exposing himself unnecessarily to plant and factory hazards he does not serve his interest nor that of his employer, but actually is jeopardizing both.

I firmly believe that the employee, if convinced that his employer's interest in seeing that he is not hurt is prompted by good will and human kindness, will respect and admire his leader all the more for that interest in him and his welfare. He is not in a position to ask that he be protected; he would feel that it was undignified and cowardly to do so, but the responsibility is on the executive none the less. I wish that everyone who has labor under his control and who feels a proper responsibility for their welfare, could carry in his mind and heart thoose lines of Pope, which, though written

two centuries ago, seem prophetic in their application—

Teach me to feel another's woe
To hide the fault I see
That mercy I to others show,
That mercy show to me.

May God speed the day when this thought shall guide and govern our conduct.

Canadian Asbestos Industry

In 1926 Canada had the largest production of unmanufactured asbestos ever recorded. Practically all of the producing asbestos mines are located in the eastern townships of Quebec, the production of that Province for the year being 279,389 tons, valued at $10,095,487. This represents an increase of 2.2 per cent in tonnage and 13.8 per cent in value over the production of the preceding year. The larger increase in value is accounted for in part by the more effective control of output exercised by the merged companies known as the Asbestos Corporation (Ltd.), the largest producer in the district. This merger became operative January 1, 1926, and it is reported that the new organization is making slow but steady progress. The effect of the amalgamation was apparent in satisfactory price increases of the high-grade fiber during the year. The corporation has doubled the output of its most efficient mill and closed some of the high-cost mines and mills to reduce operating costs.

With the merging of the seven asbestos companies in 1926, the number of companies engaged in active operations in the Quebec asbestos field has been reduced to eight, which operate 11 asbestos pits and 14 mills. Eight mills formerly in operation are now inactive. Five of the companies now operating are interested in the Thetford mines, the other three working in other sections of the Province.

Stocks on hand at the end of 1926 totaled 56-827 tons, appreciably more than at the close of 1925, owing to the large amount of low-grade fibres which remained unsold. Stored stocks of long fiber, from crude No. 1 to shingle fiber, were lower at the end of 1926 than at the close of the preceding year, but the short-fiber asbestos, comprising paper and mill-board stock, fillers, floats, etc., was higher.

The quantity of rock mined and hoisted during 1926 totaled 4,483,361 tons of this amount 4,002,626 tons were sent to the mill and the remaining 480,735 tons were sent direct to the dump as barren. Out of the total rock hoisted, 301,044 tons of fiber were produced. Thus, during 1926 a quantity of 134.3 pounds of asbestos having a value of $2.35 was produced for each ton of rock hoisted, compared with 129.7 pounds valued at $1.95 for 1925 and 124 pounds valued at $1.83 for 1924. A survey of the milling capacity of the various asbestos milling plants, either in operation or in condition to start on short notice, shows that a total of 20,640 tons of asbestos rock can be treated per 24 hours.

The asbestos properties of American corporations are reported to have been in operation at full capacity throughout 1926, and extensive work in removing the overburden was carried on to extend mining operations toward the north of the Thetford mines.

No large price increases in unmanufactured asbestos are looked for in the near future. Increased demand for the fiber, owing to the increased uses to which it is being put, will only serve to stimulate the output of the Canadian mines as well as those of South Africa and other countries. Exports of Canadian asbestos for the past two years are shown as follows:

Canadian Exports of Asbestos

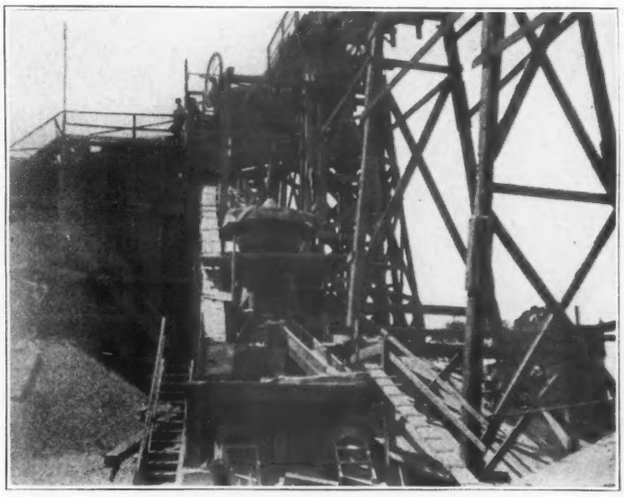
Country of destination	1925 *Short tons*	1926 *Short tons*
United Kingdom	8,709	9,304
United States	209,879	224,334
Australia	1,360	1,605
Belgium	6,223	10,323
Denmark	100	126
France	5,713	7,211
Germany	11,120	14,193
Italy	3,800	3,794
Japan	7,127	4,518
Netherlands	3,558	2,443
Other countries	428	140
Total	258,017	277,991

Declared exports from the Sherbrooke district to the United States for the first eight months of 1927 include 2,772 tons of crude asbestos, 50,228 tons of mill fiber, and 71,348 tons of asbestos in all forms, compared with 137,772 tons shipped during the first eight months of 1926. Figures for the fiscal year ended March 31, 1927, show shipments to the United States of 88,638 tons of asbestos, 121,232 tons of asbestos sand, and manufactures of asbestos to the value of $19,702 during the 12 months, all these items being smaller than the corresponding figures for the preceding fiscal year, while shipments to the United Kingdom showed considerable increases over the same interval. It appears evident that the improved organization of the asbestos industry has not resulted in any noticeable increase in exports so far. The industry is now, however, in a good position to respond to increase demand, and it appears likely that its present markets will be well maintained. Announcement has been made of extensive programs of development for mines and mills for the near future. (Vice Consul E. L. Moore, of Sherbrooke in Commerce Reports, October 3, 1927).

RICHARDSON SAND AND GRAVEL PRODUCES AT REMARKABLY LOW COST

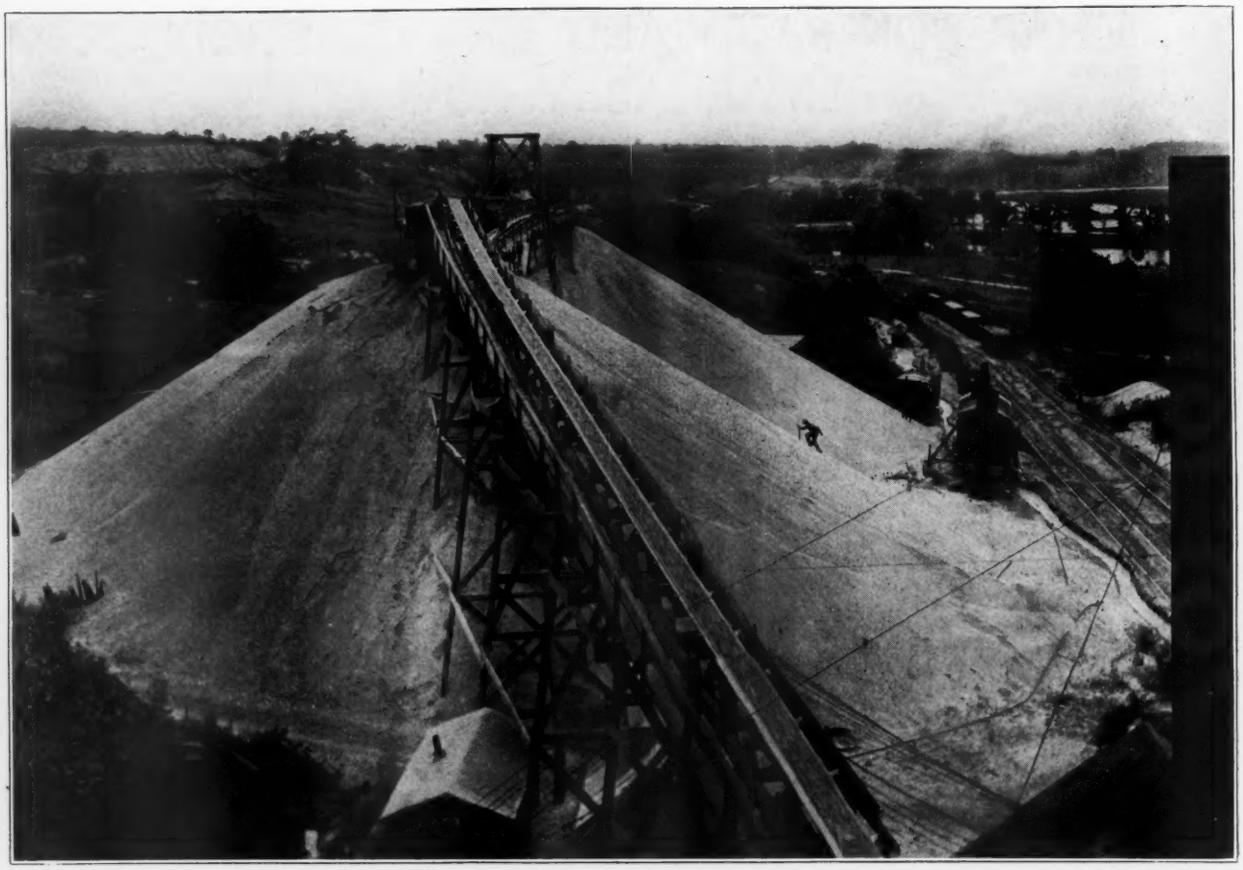
LYING on the banks of the picturesque Fox River, the two plants of the Richardson Sand Company at Carpentersville, and Coleman, Illinois, utilize some of the oldest methods known to the industry to produce a good tonnage at a remarkably low cost. The company, which started operations way back in 1883 under the guidance of F. M. Richardson, who died about four years ago, was incorporated in 1905, the present officers being T. C. Moulding, president, and R. P. Duffy, secretary and treasurer.

At Carpentersville the company has excavated about 40 acres and has approximately 100 acres under lease yet to be worked. The pit is circular in shape with a face averaging 50 to 75 feet in depth and about a half mile in circumference. The floor is 50 feet above water level and so, in spite of being a "bank operation," the pit is dry at all times. The material is excavated by means of a 70 C Bucyrus steam shovel equipped with a 2½ yard bucket and is loaded directly into standard 50 ton Roger ballast type railroad cars. These cars are hauled by a 35 ton American saddle tank steam locomotive for a distance of about ¼ mile to a side feeding concrete hopper of 300 cubic yards capacity. Material from the hopper falls on to a 30 inch Stephens Adamson main conveyor belt on 200 foot centers. This conveyor and the two other conveyor belts to be later mentioned, are driven from a 200 h. p. Corliss engine through shafting and rope drives. An odd feature of this main conveyor belt is the fact that it runs practically on a level on account of the fact that the plant is at the bottom of the bankside. This con-

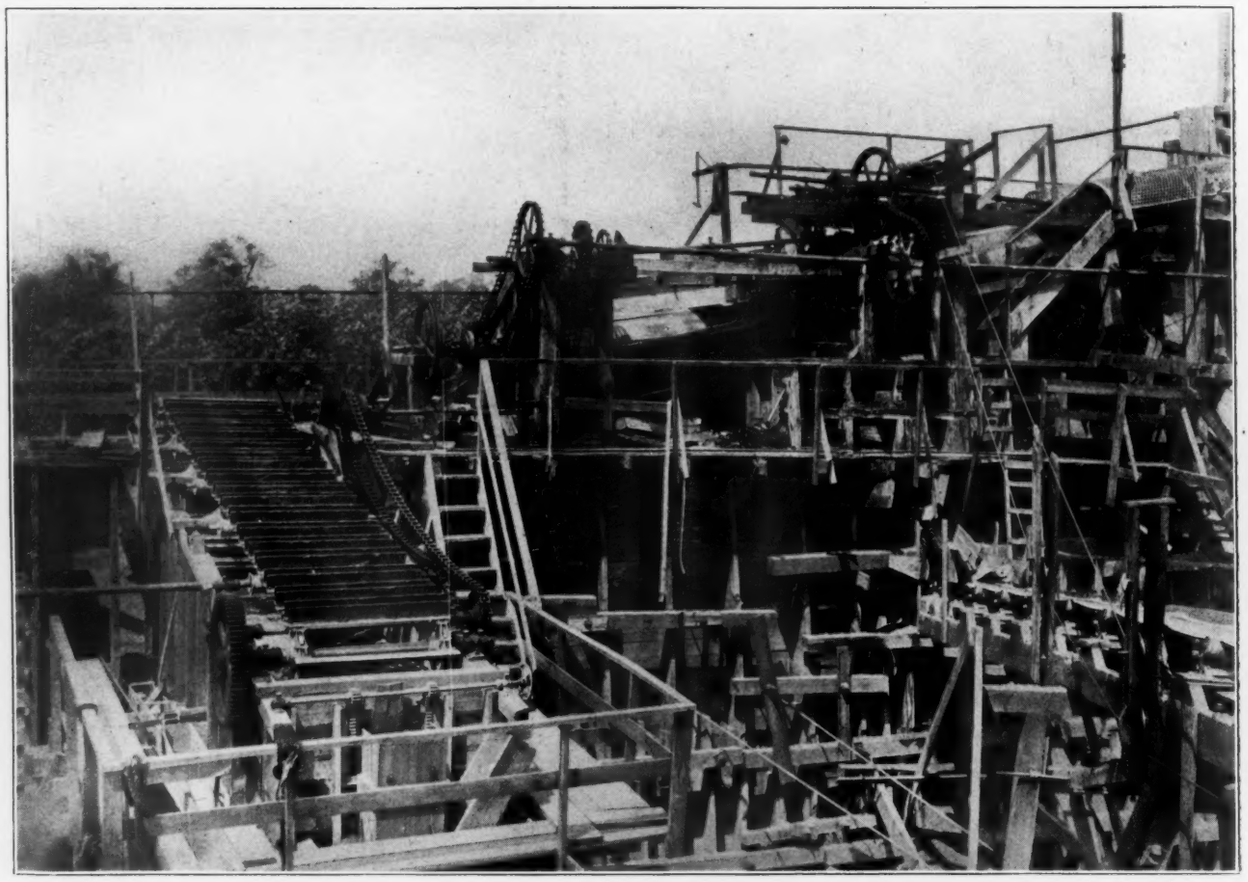


Crusher at Coleman Plant

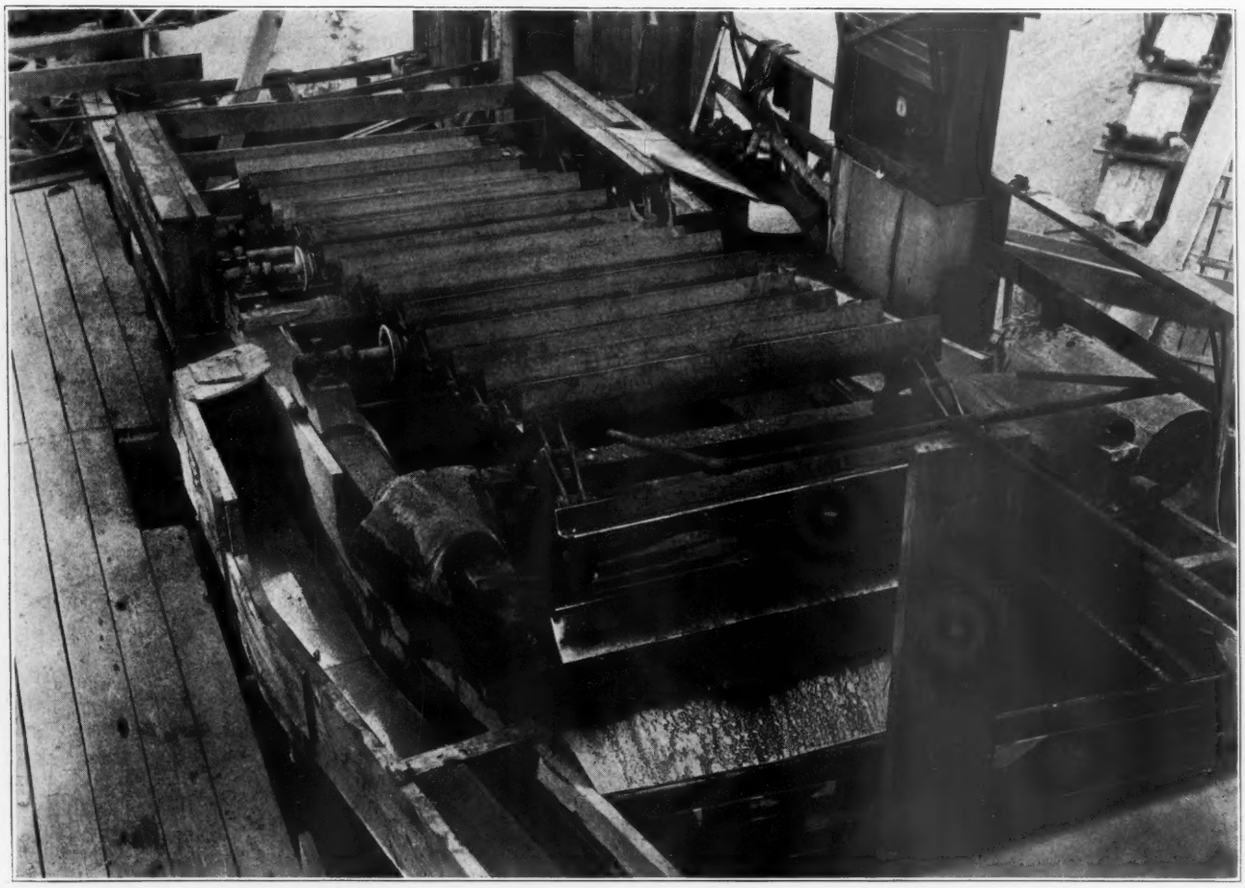
View of Plant at Carpentersville



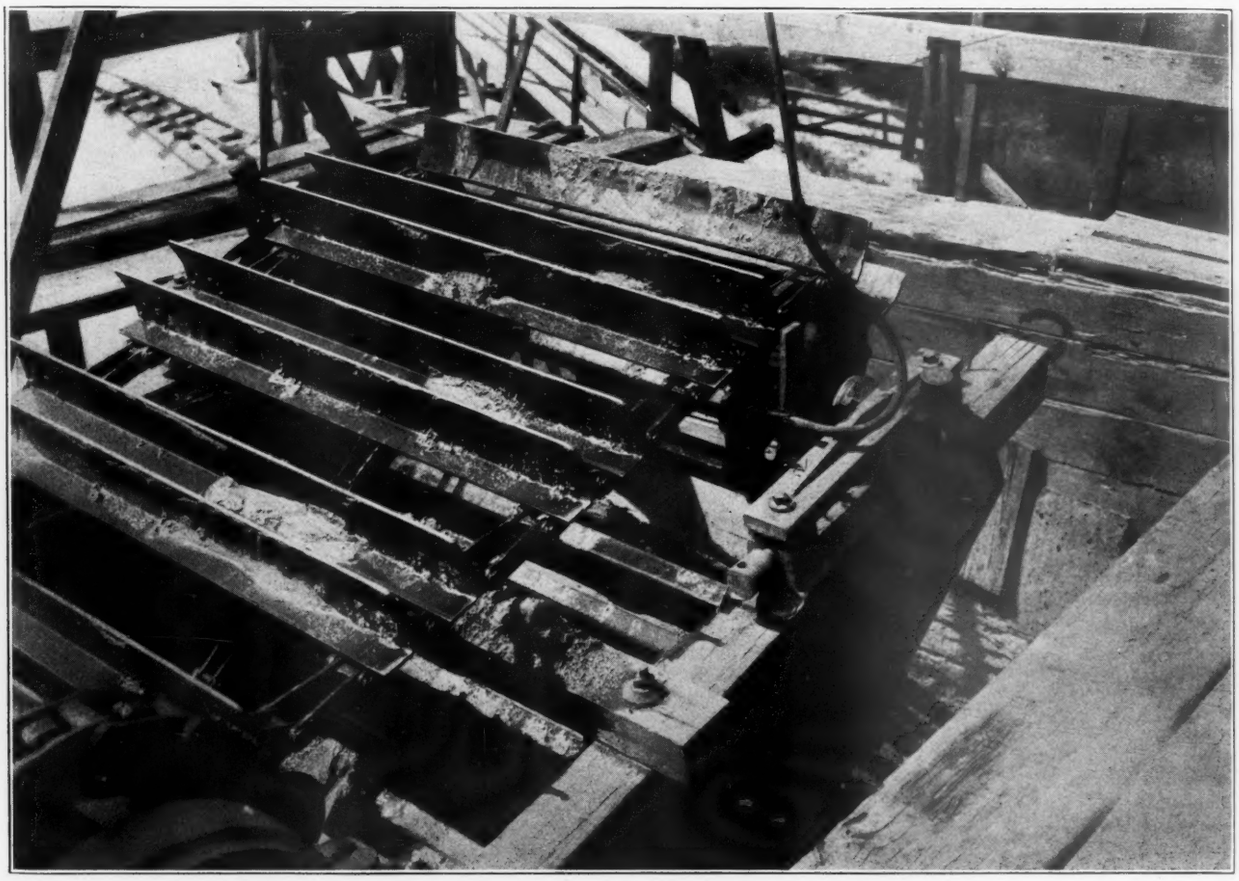
Outside Storage at Carpentersville



Sand Classifiers Are Shown at the Left for Coleman Plant



Sand Washing Plant at Carpentersville



Sand Washing Plant at Coleman

veyor takes the material to two rotary scalping screens, built in a local foundry, and driven through shafting from the Corliss prime mover. The material over 2½ inches, rejected by the scalper, drops into two gyratory crushers, one of which is a number 5 Gates and the other a number 5 McCully. The crushers drop the material onto a 24 inch Stephens Adamson return gravel conveyor on 150 foot centers which takes the gravel to a chute where it is fed back on top of the stone on the main conveyor belt. The through from the scalpers passes into three sets of sizing screens and scrubbers, the scalpers and sizing screens being built in tandem throughout, and these size the stone into 2½ inch down to 1¼ inch, known as number 9 gravel, used in heavy concrete work where specified; 1¼ inch to ⅜ inch, known as number 8 gravel, used for lighter concrete work such as sidewalks, etc.; ⅜ inch down to ¼ inch, known as number 5 or roofing gravel, and from ¼ inch down, known as number 2 or torpedo sand. Attempts were at one time made to produce a finer or number 1 sand, but this was given up as it spoiled the number 2 size due to the fact that there are practically no fines. The two scalpers and six sizing screens are 48 inches in diameter and from 12 feet down to 9 feet in length and are driven from the Corliss prime mover. The sized material from these screens drops into four bins having a total capacity of 800 tons. A 48 inch by 18 feet Stephens Adamson sand classifier separates the torpedo sand.

The supply of water for washing the gravel and sand is obtained from a private pond which is about one acre in extent and twelve feet deep, fed by springs and dammed off so as to send the water direct to a sump at the engine house where it is pumped by a 150 h. p. centrifugal pump driven by a 25 h. p. Allis-Chalmers motor at the rate of about 1,000 gallons per minute. This forces the water through a six inch pipe up a lift of about 60 feet to the flumes underneath the sizing screens. All waste waters flow back to the settling basin on the property and the overflow sluicing level is regulated by a Stephens Adamson weir gate, which allows the clear water to flow into the Fox River.

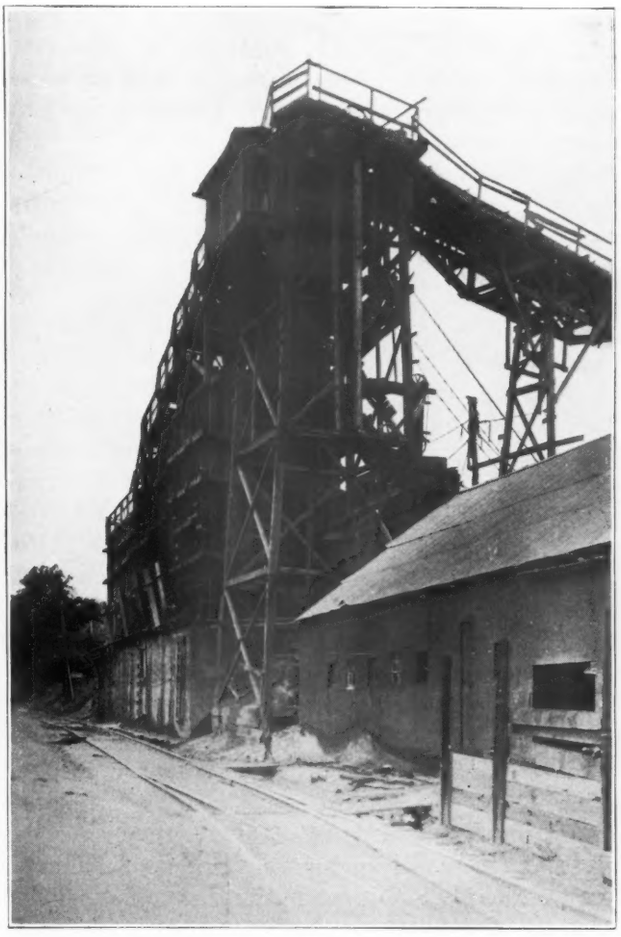
The bins holding the four sizes of material from the sizing screens are equipped on one side with chutes which load directly into railroad cars and on the opposite side and at the same point are equipped with chutes which feed onto a short conveyor belt. This 24 inch Stephens Adamson belt is on 42 foot centers and is driven by a 7½ h. p. Allis-Chalmers motor. When number 8 gravel is to be stored this short conveyor belt takes the material from the number 8 gravel bin and deposits it on the number 8 gravel belt conveyor which is on 225 foot centers driven by a 25 h. p. Allis-Chalmers motor. This belt takes the material to the number 8 gravel open storage pile where facilities for 25,000 yards of storage are available. When storing number 5 gravel the short conveyor belt takes the material from the number 5 gravel bin, deposits it on the number 8 gravel conveyor and from

Showing Partial Storage and Loading Facilities at Coleman Plant

the end of this it is deposited on the number 5 gravel conveyor which is on 138 foot centers driven by a 25 h. p. Allis-Chalmers motor. This takes the material to the number 5 storage pile where facilities for 10,000 yards storage are available.

The number 2 sand going to storage is taken direct from the number 2 bin and instead of being deposited on the short conveyor belt is fed direct to the number 2 conveyor which is on 132 foot centers driven by a 25 h. p. Allis Chalmers motor. This takes the sand direct to its own storage pile which is in an opposite direction from the gravel storage piles and where storage capacity of 10,000 yards is available. All of the storage belt conveyors are 24 inch and Stephens Adamson manufacture.

The number 9 size gravel is never stored as, if there is no demand for it, it is broken up into the smaller sizes. Frequently an order for a mixture of number 9 and number 8 sizes comes in and this is filled by mixing the two sizes as they come from the bins into the railroad cars by joining the two chutes and regulating the openings from each bin to conform to the percentages required by the specifications. In loading number 8 gravel from the storage pile to cars the material is picked up by a Marion 35 ton steam shovel equipped with a 1½ yard bucket and loaded directly into cars for which there are two gravity switch tracks along side. The number 5 size is picked up by a Byers



Loading Arrangement at Carpentersville

Conveyor to and From the Crushing Plant at Carpentersville

truckcrane equipped with a ⅝ yard Kiesler clamshell bucket on a 30 foot boom and is also loaded directly into cars. The number 2 sand is loaded directly into cars by a one yard Sauerman dragline scraper.

The Carpentersville plant has a total output of about 2,000 tons per day, the product being mostly sold for municipal and state paving and industrial work. Direct switching connections to the Chicago and Northwestern Railroad are available.

Coleman Plant

The Coleman plant of the Richardson Sand Company is in many respects an exact duplicate of the Carpentersville plant. At Coleman the company has excavated about 100 acres and has 80 acres under lease to be worked. The face of the deposit here is shallow, averaging only about 25 feet in depth by about ⅝ of a mile long. It is a "bank operation" just above the Fix River water line and like the other plant, is dry. Material is excavated with a number 80 Marion steam shovel equipped with a 3½ yard bucket which loads direct into 50 ton Roger ballast type standard railroad cars. A 50 ton American saddle tank locomotive hauls these cars a distance of about one mile to the side feed concrete hopper which is of 250 cubic yards capacity. This hopper feeds the material on to a 30 inch Stephens Adamson hopper feed conveyor belt on 38 foot centers which deposits the material on to the 30 inch Stephens Adamson main coveyor belt, which is on 198 foot centers driven through shafting and rope drives from a 250 h. p. Corliss steam engine. This belt takes the material to the scalpers and sizing screens which are in tandem and exactly the same as at the Carpentersville plant. The oversize from the scalpers passes into a number 6 Gates crusher, a number 5 Gates crusher and a number 5 McCully crusher and the return belt conveyor in this case is on 98 foot centers. The sized grand and sand goes into four bins of 1,000 tons total capacity. A 60 inch by 25 feet Stephens Adamson sand classifier separates the torpedo sand.

The water supply at this plant is taken from the Fox River by a 100 h. p. Canton Hughes high pressure pump with a 10 inch intake and pumped 2,300 feet through a 6 inch pipe at the rate of 1,250 gallons per minute to the flumes underneath the sizing screens. An auxiliary water supply is secured from a private 10 acre pond, water being driven through a 4 inch pipe line about 500 feet by a gasoline driven pump.

In taking the material from the bins to the storage piles the number 8 gravel is taken directly from the number 8 bin on a 24 inch Stephens Adamson belt conveyor, the first section of which is on 46 foot centers with extensions which now run out about a total distance of 150 feet to the

Trainload of Material Ready to Move From Coleman

storage pile. The number 5 gravel is chuted from the number 5 bin to a 24 inch Stephens Adamson belt conveyor on 81 foot centers to the number 5 storage pile. The number 2 sand is taken directly from the number 2 bin on a 24 inch Stephens Adamson belt conveyor on 58 foot centers plus extensions when necessary. All of these belts are driven through shafting and rope drives from the Corliss prime mover.

Storage capacities are: for number 8, 25,000 yards; for number 5, 8,000 yards, and for number 2, 8,000 yards. The number 8 is loaded with a Marion A157 steam shovel equipped with a one yard bucket and the number 5 and number 2 are loaded with a Byers truckcrane.

The Coleman plant has an output of 1,700 tons per day and has direct switching connections with the Illinois Central Railroad. The product is sold as railroad ballast, for construction, industrial work and paving.

(*Continued from page 50*)

Magnetic Separator Company working in co-operation with the U. S. Silica Company. Approximately 75 tons of sand per hour are handled by the separator.

The process has been made necessary due to the fact that the U. S. Silica Company manufactures a glass sand which is sold on a guarantee that the iron content will not exceed a definite fixed percentage of iron oxide. Each batch of sand is accompanied by an analysis of iron oxide made as a matter of routine by the R. W. Hunt Company and over a period of 13 months an average iron oxide contents of 0.0184 per cent has been maintained. hTe highest iron oxide content reported over this period was 0.025 per cent and the lowest was 0.009.

Through the whiptaps the sand falls by gravity through chutes to 10 concrete storage bins. These bins have a capacity of 420 tons each and deliver the graded sand direct to cars through gravity loading spouts. Gravity loading switch tracks connecting with the Burlington and the Rock Island Railroads run on either side of the storage bins and give the company excellent shipping facilities.

With a capacity of 900 tons per 24 hour day in the old plant and 1,200 tons per 24 hour day in the new plant at present and with facilites for increasing the output of the new plant by 2,400 tons per 24 hour day when the four additional dryers are put into operation the company will have unusual facilities for a large production operation.

The older drying department is 107 feet long by 55 feet wide by 55 in height and the new drying department is 165 feet long by 55 feet wide by 65 feet high. An American Blower circulating fan driven by a 5 h. p. motor is used in the new dryer plant.

The officers of the company are Volney Foster, president and treasurer, and H. F. Goebig, vice president and secretary. W. J. Witt is superintendent and plant manager.

September Construction Record

September construction contracts in the 37 states east of the Rocky Mountains amounted to $521,611,000, according to F. W. Dodge Corporation. This amount was 6 per cent under August, and 7 per cent below the total for September of last year. Construction in these 37 states includes about 91 per cent of the total in the United States. The most important items in the September contract record were; $202,877,200, or 39 per cent of all construction, for residential buildings; $126,229,500, or 24 per cent, for public works and utilities; $59,617,400, or 11 per cent for commercial buildings; $45,545,800, or 9 per cent, for industrial construction; $29,243,700, or 6 per cent, for educational buildings; and $21,970,200, or 4 per cent, for social and recreational projects.

New construction started in the 37 Eastern States during the first nine months of this year has amounted to $4,796,482,100; compared with the total for the same period of last year ($4,840,779,800), this figure shows a decline of less than 1 per cent. Contemplated new work to the amount of $667,291,700 was reported in September, representing an increase of 1 per cent over the same month of last year, and a decrease of 9 per cent from the August figure.

Soap as Concrete Waterproofer

Soaps added to the concrete mixer are effective in preventing the absorption of water by capillary action, even when added in very small amounts, according to a paper read recently by White and Bateman. They must be added in a form to ensure extremely fine subdivision and dispersion in the concrete. As little as 0.05 per cent of fatty acid in the form of soap based on the weight of concrete is sufficient if it is finely divided and uniformly distributed. If the concrete is well made and thoroughly cured, the colloid near the surface swells when it becomes wet and fills the pores so completely that the penetration of water may stop before the water has progressed many inches from the surface. The strength of concrete is not impaired by the addition of soaps in the proportions stated, provided it is kept damp continuously after pouring until it has attained the desired strength and provided the soaps have not caused foaming. Concrete containing soaps gains strength very slowly after it has dried because it resists the absorption of water. Soap-containing concrete must be kept damp at least seven days if it is to attain a strength comparable with the plain concrete. Anon. (Conc. & Const. Eng. Sept. 1927. p. 527).

Decolorizing China Clay

Clay made into a paste with water is decolorized by treatment with a hyposulphite and an organic acid. The clay is then filtered and washed. P. E. Wickham (British Patent 273, 373).

A DISTINGUISHED TRAP ROCK OPERATION

By F. A. Westbrook

AT MT. CARMEL, Connecticut, about ten miles north of New Haven, is one of the plants of the Connecticut Quarries Company. It is distinguished by having a breast 315 feet high —the highest of any quarry of its type in the eastern part of the country. In fact the top of the hill has not yet been reached so the height of the breast will continue to increase for some years to come as drilling operations progress. The product is an extra good grade of trap rock.

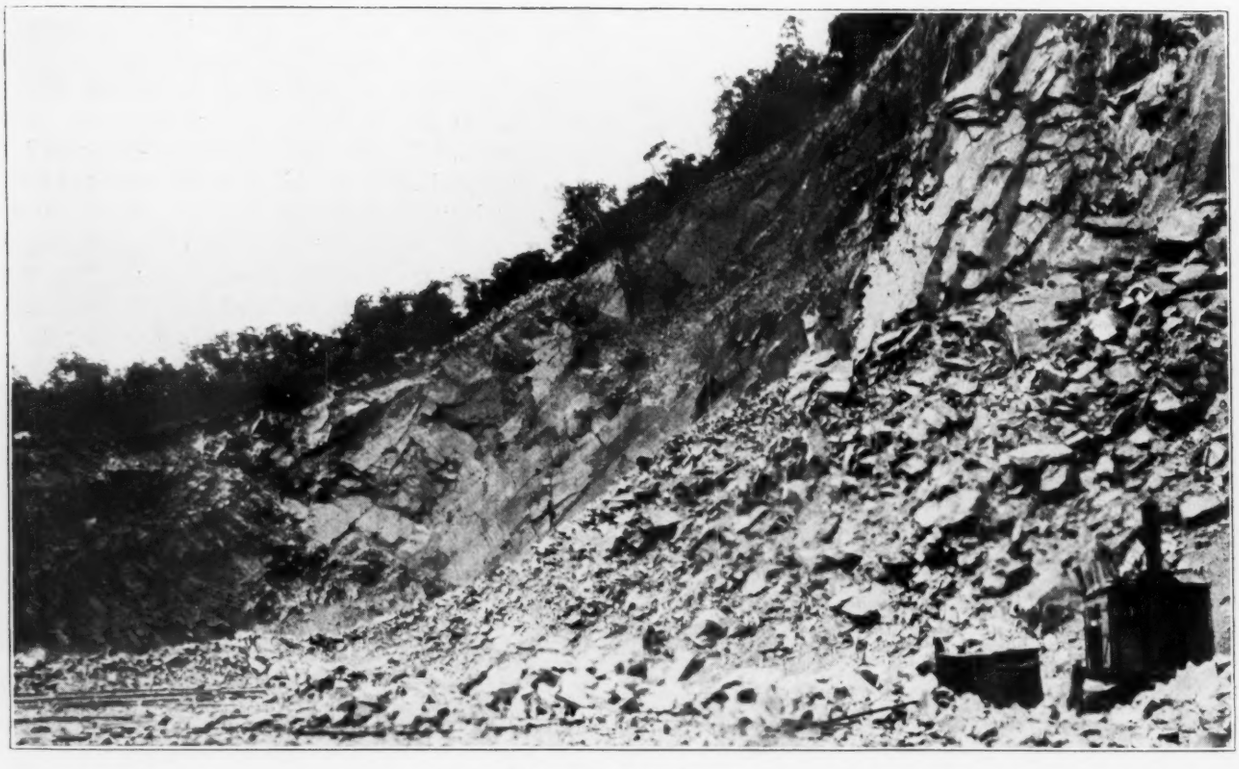
This extreme height of breast has led to the adoption of the coyote or tunnel method of drilling at bottom and on benches. As a general thing this consists of quarrying a tunnel 36 inches wide by 42 inches high for 50 feet straight into the wall of rock. At the end of this and at right angles to it branch tunnels of similar size are made substantially parallel to the face. One of the requirements is that the tunnels should have a slight grade toward the outside to provide for drainage. Charges of dynamite are placed at intervals of 15 ft. in the tunnels, the size of the charge depending upon the thickness of the wall at the point where the charge is placed. A tunnel plan for a blast made some time ago is reproduced and gives a good idea of how the tunnels are laid out. Du Pont dynamite, 40 and 60 per cent, is used. Ingersoll Rand jack hammers are used for secondary drilling and tunneling.

Loose stone is picked up at the face of the quarry by an Erie shovel equipped with a three-quarter yard Frog Switch and Manufacturing Company dipper. The stone is placed in Easton end dump cars and these are hauled, one at a time, by a 3 ton Plymouth gasoline locomotive to the primary crusher. The floor of the quarry is practically flat so that there is no great haulage problem.

The quarry cars are backed on to a tipping platform at the primary crusher. This is located below the floor of the quarry so that the stone drops directly into it. It is a 30 by 42 inch Buchanan jaw crusher and over it is a Curtis air hoist for use in dislodging large pieces of rock which may become jammed or bridge over the opening.

From the primary crusher the stone is taken in a Stephens Adamson elevator chain designed by Mr. J. H. Cooke, to the number 7½ Gates gyratory crusher. Mr. Cooke, it will be remembered from other articles appearing in "Pit and Quarry," is president of the Lynn Sand & Stone Company of Swampscott, Massachusetts, and of the Hartford Sand & Gravel Company of Hartford, Connecticut. He was formerly connected with the Connecticut Quarries Company and this elevator is among the good things from his former association with this company.

The secondary crusher discharges in the 60 inch



View of Part of Quarry

by 12 foot Rolman manganese steel rod scalping screen. The tailings from this are divided between two number 4 Gates gyratory crushers and these, together with the troughs from the scalping screen into which the Jeffrey elevator discharges belt elevator which takes the material up to the screen room at the top of the plant.

The two sizing screens now in use are made of boiler plate but Rolman screens are to be substituted for them in the near future. The first screen into which the Jeffirey elevator discharges has 2½ inch holes and is provided with a jacket having 1½ inch holes. The tailings from this screen drop to a number 4 McCully gyratory crusher which in turn discharges into the Jeffrey elevator as shown in the attached flow-sheets. Material passing through the 2½ inch holes gives the 2 inch stone and the tailings from the jacket give the 1 inch stone. The trough from the jacket passes into the second revolving screen which is at right angles to the first and at a lower level. This screen has ⅝ inch holes and its jacket has ¼ inch holes. Thus the tailings from the main part of the screen give the ¾ inch stone, the tailings from the jacket the ½ inch stone and the dust and fine material comes through the jacket. The production with this equipment is 800 tons per day with 20 men.

Power is furnished by the company's own plant. This consists of a 175 h. p. Westinghouse compound non-condensing engine which is at present running at an indicated horse power of 237. The engine is direct connected to a shaft from which

Top View Shows Secondary Drilling Operation. Lower View Shows the Plant Office With Quarry in Background

Quarry Face Not Long After a Blast

the various machines are driven mostly by Goodyear Bluestreak belts. Of course in a stone crushing plant there is a great deal of dust so that slipping of the belts becomes something of a problem. Here it is prevented by having the belts tight and sometimes applying Cling Tite belt dressing. Steam is supplied by a 78 inch Bigelow return tube boiler operated at 150 pounds pressure. A Standard scale is used in the boiler room for weighing coal. A Sullivan compressor furnishes the supply of compressed air. The repair shop is housed in a very substantial concrete building. An Ingersoll-Rand drill sharpener, Champion Blower and Forge Company drill press, Whirlwind grinder and other machines are installed here.

Shipments are made by truck, railroad and also in large quantities by trolley as is the case of a number of plants in Connecticut. The trolley cars are run under the storage bin for loading. Many of them carry several boxes equipped with electrical dumps and are referred to as "multiple cars." In many instances these cars are able to deliver material directly to jobs over a wide radius of adjacent territory. The stone company also has storage bins in Waterbury and Stamford, Connecticut, which are kept supplied by these cars. In fact this trolley service seems to be of great advantage as it provides transportation facilities at a reasonable cost with a minimum of trouble to the producers. It must also provide a very acceptable source of revenue to the electric railway company in these days when the returns from passen-

Shovel In Operation In Quarry

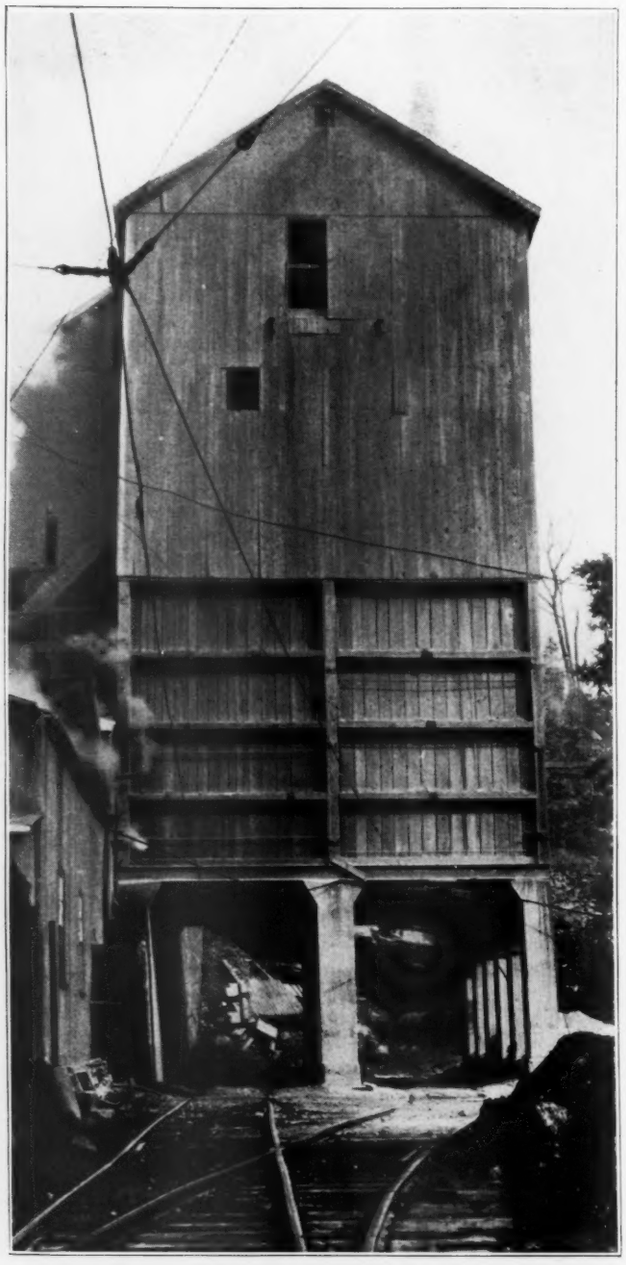
ger service are falling off and the arrangements of this kind which have been observed around Hartford and New Haven might well be extended wherever practicable to the profit of all concerned. The company has a neat and well laid out office building near the storage bins. The trolley passes on one side where a Buffalo scale has been installed to weigh the car loads. On the other side of this building is a Fairbanks scale for weighing truck loads of stone.

Albert L. Worthen, vice president and general manager of the Connecticut Quarries Company is the author of a booklet entitled "Crushed Trap Rock" in which he gives some pertinent data on the use of steel bins. These bins were manufactured and installed by Davis and Averill, Incorporated. As some data in this booklet pertains particularly to the problems of the Connecticut Quarries Company, we quote some of the comments by Mr. Worthen.

"The term 'steel bins' has rather a broad meaning, and our requirements in this line might better be expressed as specialized steel bins. That is, bins built to the exact needs of the quarryman who may seek an additional outlet for his product. The adoption of these steel bins proved a wise and logical choice. The installation has been one of the primary means to the successful attainments of our different service plants, for we have standardized on this equipment.

"For those who would want to know, I would say that these steel bins are of round type, equipped with an overhead conveyor system. Each bin is used for a particular size of crushed rock,

Upper View Shows Scalping Screen. Lower View Shows Locomotive Hauling Stone to Plant



Storage Bins for Stone

with gross tonnage capacity to suit the respective locality. Our first plant was started with a thousand tons capacity for five sizes. One of our plants consists of four of these steel bins, and another has six such units—and we are planning on more.

"The crushed stone leaves the overhead conveyor and empties into the respective bin by gravity. The bins taper at the bottom, with square-mouth outlet. They are mounted on a rigid structural steel frame, through which the truck or trucks are driven. The loading, as will be readily understood, is almost instantaneous. By a simple mechanism, the spout or mouth is opened, and the average truck of say 5 to 7 tons capacity, can be loaded in a minute or so.

"This, of course, means a saving of men, of time and money. Where trucks cost say $2.50 per hour and it may take a half-hour to load by ordinary means; the saving with our plan is pronounced in just this one simple instance, neglecting the other advantages. Moreover, it is giving the customer an exclusive character of service which he cannot procure elsewhere. The whole proposition is based on just this kind of service; it is fundamental with this branch of our business.

"Steel bins of this design are what might be termed self cleaning, and there is no appreciable wear on the interior steel shell; in fact, this factor is negligible, if the operator uses his good judgement and keeps the bins well filled all the time. The only upkeep, in reality, is a coat of preservative paint on the exterior about once every three or four years. As these bins are made up of standard units, the total size of the plant readily can be arranged to suit the conditions. And, a small plant can be added to easily at any time, where the increased business demands.

"And still another thing which has impressed me with the merits of the steel bins such as we are using is the "portable" character. In other words if necessary, the bins can be removed to another state and re-erected without loss. The salvage value is 100 per cent. We have had occasion to make a change of this kind and, therefore, speak from experience.

"Ground storage, of course, is not to be compared with equipment such as I have briefly described. Under such condition, there is no guarantee of service whatever to the customer; and waiting around a yard for a wagon-loader to handle the job, with consequent delays, is no unusual thing. The customer wants to get in, get his load of stone and get out—and with the steel bins he can do so in a fraction of time. This is service with a capital "S".

"Almost needless to say, our service plants have been very successful, or I would not be quite so enthusiastic. I may say that we do not go after the larger business, as the term might be implied. We seek the trade which wants first grade crushed trap rock in smaller quantities, say five to ten tons, any standard size, under guaranteed maximum service and convenience. And, I am proud to say, that trade is now seeking us. We solicit business within a radius of about eight to ten miles from our service plants. Quite naturally, quarrymen in other parts of the country can profit from our experience. It has been an interesting and profitable one, as I have endeavored to explain."

If Americans had been as courteous and cautious behind the wheels of their automobiles in 1926 as in the conduct of their business and social life, the 750,000 serious injuries occurring on the streets and highways would have been greatly reduced.

SAFETY IN THE QUARRY INDUSTRY

By W. W. Adams

Statistician, United States Bureau of Mines

SAFETY in the quarry industry is a matter of direct concern to 92,000 men who are employed in the industry and it is also of almost equally direct concern to their immediate families. Thus between 300 and 400 thousand people are personally affected by the accidents that occur in connection with the annual production of stone in the United States and in connection with the crushing and other work that immediately follows its extraction from the earth. From 120 to 150 of these men are killed by accidents each year, and 14,000 of them are nonfatally injured.

Through the cooperation of the producing companies, the United States Bureau of Mines conducts an annual canvass of accidents and employment covering the quarrying of stone, and such subsequent work as crushing, rock-dressing, and the manufacture of lime and cement. This work began in 1911 and statistics covering the past 16 years are now available. These statistics are based upon reports furnished voluntarily by the producing companies on blank forms supplied by the Bureau of Mines. Each nonfatal injury reported to the bureau involves disability of the employee for more than the remainder of the day on which the accident occurred. In other words, the Bureau's statistics are limited to what are know as "lost-time" accidents. While many of these injuries cause the employee to lose only one or two days, some of them involve the loss of several weeks or months. Taking them in the aggregate, they average about 15 days per injury. Any company whose temporary injuries average less than fifteen days each has a relatively safe plant, or is lucky, or is doing effective safety work. If deaths and permanent disabilities are drawn into the picture and given their customary equivalent weights in lost days, the average accident in the quarry industry represented a loss of 104 mandays in 1925 and 94 mandays in 1924. In this average each fatality and permanent total disability is considered equivalent to a loss of 6,000 days and each permanent partial disability 800 days, the last-named figure being borrowed from the reports of the Industrial Accident Commission of California until sufficient reports of this class of injuries accumulates in the Bureau's records to develop a new average.

In addition to the bureau's annual canvass of accidents which is based on reports from all producing companies in all States, or as nearly all of them as we can obtain, a special and much more intensive inquiry into quarry accidents has been under way during the past two years. This study is based on full and complete reports—a separate and detailed report for each accident—from a limited number of companies. Each of these companies employs at least 25 men inside the quarry. They are the companies that are participating in the National Safety Competition which is being conducted by the Bureau of Mines. Two such annual contests have been completed, namely, that of 1925 and that of 1926. One of the purposes of the safety contest is to determine which quarry has the smallest loss of time from accidents in proportion to total man hours of exposure. The quarry that establishes the best record receives a bronze trophy or statue known as the Sentinels of Safety which is the gift of the *Explosives Engineer* magazine. Credit for providing the trophy and for very material aid in connection with the contest, is due very largely to the enterprise of Mr. N. S. Greensfelder, the editor. The trophy is held for one year by the wining company, and is then surrendered to the winner of the next year's contest. Each year the name of the winning company is engraved on a pedestal of the trophy and each employee of the winning quarry receives an engraved certificate of honor issued by the Bureau of Mines and signed by the director of the bureau.

The Bureau's annual canvass of quarry accidents affords a broad picture of the accident situation as it affects the whole industry or any large portion or phase thereof; it also furnishes an annual account of the volume of employment required to produce the country's annual stone supply and of the total loss of life and limb as well as the loss in mandays that went into the cost of producing the stone. The more detailed reports furnished in connection with the National Safety Competition are usually supplied as a carbon copy of the report which the company is required to send to its insurance carrier or to the state compensation commission. In this way the Bureau is furnished with detailed valuable information on accidents with a minimum of inconvenience to the company.

It will thus be seen that the Bureau of Mines statistics of quarry accidents are collected by two methods from a common source, namely the quarry companies. It will also be observed that the statistics differ in scope, geographically, and in the degree of detail with which the information is supplied. From these two sources of information and similar information from other branches of the mineral industry, it is apparent that quarry accidents occur less frequently and cause a smaller loss of time in proportion to number of employees than do accidents at metal mines or coal mines. In other words, quarry work is not as hazardous as

coal mining or metal mining, considering each of the three industries as a whole. Moreover, differences also exist between the hazard of different kinds of quarries. Perhaps the chief distinction in this respect is between quarries that produce dimension stone and those that produce non-dimension stone. Quarries that produce crushed or non-dimension stone have higher accident rates than those that produce dimension stone. For example, the fatality rate for the non-dimension group, in and about the quarry, in 1925, was 33 per cent higher and the injury rate was 7 per cent higher than the corresponding rates at dimension stone quarries; in 1924 the rates were respectively 76 per cent and 18 per cent higher. A comparison covering all years since 1916 shows that, without exception, the group rates for both fatalities and injuries, have been higher at stone quarries producing non-dimension stone, the excess ranging from 5 per cent in 1921 to 118 per cent in 1920 for fatal accidents and from 1 per cent in 1917 to 122 per cent in 1921 for nonfatal accidents. Moreover, possible differences in length of work day at the two classes of quarries have no material effect upon this relationship. This is shown by figures which have been compiled for quarries working uniform shifts, that is, 8 hours, 9 hours, or 10 hours.

In crushed-stone or non-dimension-stone quarries, where no care need be exercised to prevent breaking the stone, it might be expected that the rate from accidents from explosives would be higher than that in quarries producing dimension stone that is intended to be used for building or monumental purposes. This, in fact, has often been the case, as shown by the annual reports which the Bureau of Mines has received from the producers of stone. It does not, however, fully account for the higher frequency of accidents at crushed or non-dimension-stone quarries. A comparison of the annual figures for the two classes of quarries during the past seven years, shows that some other classes of accidents also, as a rule, occur more often at quarries that produce crushed or non-dimension-stone. Crushed-stone or non-dimension-stone quarries show higher injury rates for accidents caused by handling rock at the quarry face, also for accidents from falls or slides of rock or overburden. Haulage accidents also are usually more frequent at crushed-stone quarries. Accidents caused by falling objects, which records for earlier years showed were of more frequent occurrence at crushed-stone quarries, have been materially reduced during the past four years, and in 1925 the crushed-stone rate for this class of injuries was actually lower than at quarries producing monumental or building stone. A somewhat similar situation prevails as to accidents from flying objects; the rates for this type of accidents have been high for both kinds of quarries, but during the past three years the non-dimension quarries have established the better record. Macinery accidents also are among the major causes of injuries at both classes of quarries, but in the past few years the crushed-stone quarries have reduced their injury rates from this cause, and since 1922 these rates for machinery accidents have been lower than at dimension-stone quarries. The net advantage, however, still lies with quarries that produce dimension stone; that is to say, the injury rates covering all classes of accidents combined is still lower for the dimension-stone quarries.

Accident prevention is a national as well as local problem. It is therefore appropriate that national associations such as the Portland Cement Association, the National Crushed Stone Association, and others, should undertake or maintain some group action looking to the prevention of accidents. In 1925, more than forty States contributed to the production of stone in the United States, and in more than 34 of the States accidents were suffered by the men who produced the stone. To the extent that quarry accidents are similar regardless of location of plants, it would seem that the national associations might with advantage undertake a study of the accident prevention problem. It has already been said that the quarry industry is less hazardous than coal and metal mines both as regards accident frequency and accident severity. This, however, is no more than might reasonably be expected because nearly all quarry work is done in the open daylight whereas most of the operations at coal mines and metal mines are conducted underground where the light, which is necessarily artificial, is often not adequate for maximum safety; also in the underground work, there is the additional hazard of falling overhead material. The quarry industry should, therefore, not be content if it merely maintains an accident rate better than that for the mining industry, but should strive to lower its rate from its own previous levels. This has already been done to some extent so far as fatal accidents are concerned but not to any material degree as regards injuries of a nonfatal character.

Of the 92,000 men working at quarries in 1925, the operator's returns to the Bureau of Mines showed 52,000 working in and about the quarry pits and 40,000 working at the outside plants. About three-fifths of the accidents occurred to the men working in and about the pits. These accidents accounted for 101 deaths and 8,632 lost-time injuries. The fatality rate per thousand 300-day workers was 2.28 and the injury rate was 195. The injury rate was the highest on record since 1915 when the statistics for inside and outside accidents at quarries were first segregated. On the other hand, the fatality rates previous to 1925 were, in four cases, better, and, in six cases, worse than the rate in 1925. These figures show that more

progress has been made in the prevention of fatalities than in the prevention of injuries. A comparison of these figures with those for outside plants shows that more progress has been made outside than inside the quarries, and this fact has contributed favorably to the record for the industry as a whole.

The number of days a quarry is in operation is largely a matter of contracts and weather conditions. Perhaps choice plays little or no part. Yet it may be interesting to know that it is apparently safer for a quarry to work full time than part time. That is to say, the accident rate per day diminishes as the number of days the plant is in operation increases. A quarry that is in operation a full year is likely to have a lower accident rate per day than if it worked only half a year. This conclusion is based on statistics which the Bureau has compiled for metal mines, which indicate a relationship between accident rates and continuity of operation which doubtless exists in quarries as well as mines.

These statistics (as yet unpublished) of metal-mine accidents show that accidents occur less often when operations are most continuous—that is, the accident rate declines as the number of operating days of the plant increases. This fact was indicated not only by the figures for all classes of metal mines combined, but also by the figures for individual groups. The combined rate over a four-year period (1921-1924) for fatal accidents among underground employees was 7.69 per thousand full-time (300-day) employees for mines operating less than 100 days per year and it was 3.77 for mines operating 300 or more days per year. The nonfatal injury rate for the former group was 675 per thousand employees, while for the latter group it was 356. Considering mines of equal or similar size, the death rate for mines employing 100 or more men underground was 8.78 for 1 to 99 days of operation and 3.71 for 300 or more of operation. When the mines were classified according to principal product, it was found that iron mines operating less than 100 days had a fatality rate of 11.92 and an injury of 836, whereas those in operation 300 days or more had a fatality rate of 3.01 and an injury rate of 174. Similarly, copper mines had a death rate of 7.58 and an injury rate of 841 for less than 100 days of operation and a fatality rate of 4.09 and an injury rate of 435 for 300 or more days of operation. These figures for metal mines were for extreme groups in respect to operating time; rates for adjacent groups indicated the same tendency, but less clearly.

Similar figures for quarries have not as yet been compiled, but we hope to be able to prepare them in the near future.

The experience of 44 plants in the National Safety Competition of 1926 was classified on a monthly basis to learn the seasonal variation in the amount of exposure and the seasonal variation if any in the accident frequency rates. These 44 plants had a total exposure of 7,815,377 man hours. The severity rates were also calculated on a monthly basis, but the occasional occurrence of a fatality, with its equivalent of 6,000 days, rendered the severity rates too variable for comparative purposes. The volume of exposure, as might be expected, reached its lowest level during the winter—in January; it increased steadily through June, and held this level through July, then declined slightly but steadily through August, September, and October, and continued to decline more rapidly in November and December. The maximum exposure, in June, was 2¼ times that of January. The frequency of accidents was smallest during the four winter months of November, December, January and February; it was much higher in other months, the average rates being about 50 per cent higher for the months of greatest activity.

In order to form a mental picture of the field that lies ahead of any prospective safety program, it may be helpful to state that so far as quarry safety rests with the operators, it is necessary to reach only a small number of companies to encompass a large proportion of the employees. Less than 700 quarries employ as many as 25 men in the pit and these 700 or less plants employ 80 per cent of all men that work at quarries in the United States. If 50 men inside the pit are considered necessary to entitle a plant to rank as a large quarry, then such plants number less than 300 and they employ nearly 60 per cent of the total quarry workers in the United States. These facts are referred to because the cooperation of the company as well as the employees must be obtained to make safety work effective. A relatively small number of companies have it within their power to give a tremendous impetus to quarry safety work that will benefit 80 per cent or more of the entire industry.

The accident rates for the whole quarry industry are but slight indication of what individual companies can accomplish. For example, the industry's accident-severity rate for work inside the pits, as nearly as it can be computed from available records, was 8.202 in 1925 and 6.931 in 1924; the corresponding group rate for companies in the National Safety Competition was 7.599 in 1925 and 7.760 in 1926. Yet in the 1925 safety contest, seven quarries out of 102 and in the 1926 contest fourteen quarries out of 118 operated their plants the entire year without a lost-time accident. In 1925 sixty plants or 59 per cent of those enrolled had accident-severity rates of less than 1 and in 1926 67 plants or 57 per cent had rates of less than 1. Thus it is seen that the group average of 8.202 in 1925 and 6.931 in 1924 for the whole industry, and the National Safety Competition group averages of 7.60 and 7.76, respectively in 1925 and 1926 are by no means the best that individual quarries

can do in the elimination of accidents to their employees. In fact, the 1926 contest showed that 97 plants or 82 per cent of the total number had accident-severity rates that were better than the group average; 21 plants or 18 per cent of the total number had rates that were higher and therefore worse than the group average. This means that 18 per cent of the companies were mainly responsible for the group average being as high as it was. Has it not been for the many good companies, the rate would have been much higher. The record, in fact, showed that the companies whose rates were better than the average had a group rate among themselves of 2.314 while the rate for those whose record was worse than the average was 38.695; 2.314 for the good companies; 38.695 for the bad companies, an average of 7.760 for both combined. The bad companies had a rate that was more than 16 times that of the good companies.

The purpose of these and similar statistics is to make it possible for individual quarries to compare their accomplishments in accident prevention with what has been done by other companies. Any individual company may be remarkably successful in the elimination of certain classes of accidents and equally unsuccessful in combatting other types. Neither the degree of success nor the degree of failure can be known without some standard of measurement. The National Safety Competition of 1926 has shown that while all of the quarries combined had a group rate of 7.760 yet 82 per cent of them had lower rates than that figure. The rates ranged from zero to more than 200. Rates for the individual companies have been published, but in such a way that the identity of each company is concealed. Each company has been advised of its own rate and of its relative standing among all companies. Copies of a circular containing these rates are available to any company upon request. Incidentally it may be stated that the circular also contains the rates of coal mines, metal mines, and non-metallic mineral mines. All of these rates have been calculated on a uniform basis and are therefore strictly comparable. The method of compilation is simple. Any company may easily prepare its own accident records in the same way. Those companies that see fit to do so will find that they are following a practice that has become standard not only in the mineral industry but in other industries as well. Following such a practice, any company may readily learn how it ranks with other plants of the same type or with any other industrial unit. It is hoped that the companies represented at this meeting may find it practicable to place their accident statistics on this standard and widely accepted basis. In the event that any company establishes a safety record better than those indicated in the National Safety Competition, the Bureau of Mines would appreciate it if the company making the record would inform the Bureau of the fact. The Bureau desires to learn of cases of this kind so that suitable public recognition may be given.

Expansion and Contraction of Plaster During Drying

Plaster of Paris was mixed with 50%, 70% and 90% water and cast into small test cakes. The variations in length were observed until this dimension became constant. The amount of water added does not have a great effect upon the expansion, but the test with 90% water required longer to become constant in length and expanded slightly less than the others. The expansion is greater at the beginning with increasing water content, passes through a maximum and then decreases. It was also found that plaster of Paris retains 20% of its weight of water, and the volume of the voids was 29.4%. Anon. (Union technique du Bâtiment et des travaux publics).

Conceptions of Portland Cement

An exact scientific clarification of Portland cement conceptions cannot be made. Practice in cement manufacture which furthers such a clarification has taken each step in the manufacture and made narrow provisions for each step, which gives the desired product. This procedure satisfactorily replaces the specifications of the chemical constitution of cement. Furthermore, a cement which does not comply with standard theoretical ideas will not exhibit the customary "Standards for Portland cement" either. C. Haegerinann (Zement. August 25, 1927. 728-731).

Colorizing of Cement and Concrete

Vat dyes, either already dispersed or in easily dispersible form are added to the water used in gauging cement and concrete. Thioindigo Red B, Indanthrene Blue, Duranthrene Golden Orange Y, and Duranthrene Claret give respectively pink, blue, yellow and bordeaux shades. Baddiley, Shepherdson and Davidson (British Patent 273, 477).

Pit and Quarry First

H. P. Arms, sales director, El Dorado Lime and Minerals Company writes "We consider Pit and Quarry to be the best publication of its kind which we are able to get. Not so long ago we relied on other trade magazines to keep us advised of information pertaining to the lime industry. It has been our observation that many technical articles involving research work are now printed first in Pit and Quarry. We think you deserve credit for having improved the size of your magazine, the type and the editorial policy."

GYPSUM BURNING ECONOMIES

By B. Saegebarth

GYPSUM yields three different products that are of very great importance in modern industry and that vary in accordance with the method of manufacture. These are plaster of Paris, gypsum used for modelling purposes and estrich gypsum or Keene's cement. In making the first two varieties a part of the water present in the raw gypsum is driven out at comparatively low temperatures. The gypsum that is obtained in this manner is rapid setting, which means that it will harden within ten to twenty-five minutes after it has been mixed with water. If the raw gypsum is subjected to too high a temperature during its burning, then it is dead burnt and cannot be used as such but only after repeated calcination at a temperature of 870 to 970 degrees C. Then it gives a product, known as Keene's cement or builder's gypsum.

In the following article some interesting information is given on the manufacture of plaster of Paris from the standpoint of the economy of the process, with particular attention to the use of a rotary kiln for this purpose. The rotary kiln has been introduced into several European countries and has been used there with considerable success.

The details of the ordinary boiler or digester process of making plaster of Paris need not be given here for they are well known. The fact that the raw gypsum has to be ground into the form of a fine powder means that a considerable amount of energy is consumed for this purpose. The cost of the grinding apparatus is also high. Considerable heat energy is also consumed in driving out the water of crystallization in the raw gypsum and the surface water that is held by the ground mass.

The operation is continuous up to this point, but the actual burning of the gypsum according to the old process is bound up with considerable hand labor and is essentially a discontinuous process. The group raw gypsum is burnt in boilers and is indirectly heated, that is the heat of the fire or the combustion gases first comes in contact with the iron shell of the apparatus and must be transmitted through this shell before it comes into contact with the gypsum itself.

During the entire burning process the contents of the apparatus is kept in constant agitation by means of a suitable stirring apparatus. The gypsum begins to bubble at a sufficiently high temperature. This process is carried out for so long a time under control of the power, which must be exerted to the best of advantage because of the high cost of the same, until the water content of the gypsum, that is being treated, has been reduced to approximately three to four per cent by weight. Then the apparatus is emptied by hand. The time that is consumed in filling and emptying the apparatus is lost time as far as the production of the apparatus is concerned. This lost time is costly because of the high wages paid to the operators and also because of the loss of heat that is incurred while the apparatus stands idle. The direct transmission of heat to the gypsum mass itself, which is carried out in modern establishments and which will be explained in further detail below, results in a very considerable saving in the amount of fuel consumed for burning the gypsum in comparison with the process that depends on the indirect transmission of heat to the latter.

In addition to the purely economical and industrial phases of the manufacturing process of making Plaster of Paris, the safety and certainty of the operation and also the quality of the finished product must also be taken into consideration. As has been mentioned above, gypsum, which has been either heated to too high a temperature or which has been dried out too thoroughly, is called dead-burnt gypsum and has lost its setting properties. Hence in making the product the greatest care must be taken to see that the entire mass of material, being treated, is regularly burnt. Hence the manufacturer who uses digesters for accomplishing this operation must depend in the highest degree on the watchfulness and perseverance of the operators, and both the operating certainty of the process and the quality of the finished product depend on the attention given to the process by the operating personnel. No automatic apparatus has been devised which will control the process and which will yield a product of uniform and high quality. For even when the mass of gypsum is very thoroughly agitated during the manufacturing operations, it always happens that pieces of the gypsum, which frequently come into contact with the walls of the apparatus, are soon dead-burnt, while other particles of gypsum located within the center of the mass have not yet been totally freed of their water content. These disadvantages in the manufacturing operations, as carried out in accordance with the old method, led to the development of new method and new apparatus for making this product which is explained below. The apparatus used is a rotary kiln.

This rotary kiln is shown in figure 1. Its construction is very characteristic as may be seen from this figure. A number of cross-shaped distributing plates are built into the apparatus and these plates are arranged parallel to the axis of the rotary kiln. As this kiln rotates, the entire con-

*Translated from Chemiker Zeitung.

tent of the apparatus are uniformly distributed throughout the entire cross-sectional area of the latter. Thus when the apparatus makes a single revolution, the amount of material that is located in the various cells or chambers is equalized for those that are too full yield part of their contents to those that are not full enough. The internal construction of the rotary kiln is therefore of such a character that the regular distribution of the contents of the apparatus is accomplished in an automatic manner and thus the collection of the raw gypsum in one place shortly after the apparatus is charged is prevented.

Figure 2 shows a layout of the installation in which the rotary kiln is the principal unit. The operation of the apparatus is somewhat as follows. The crude gypsum, which has first been broken up into pieces that are about the size of hazel nuts, is fed to the kiln by means of a conveying device of the screw type which is under proper control at all times. The mass of gypsum passes through the rotary kiln in the same direction as a stream of hot gases which perform the burning operation. The temperature of the heating gases, as they leave the rotary kiln, is only a little more than the proper burning temperature of the gypsum, so that the unavoidable heat losses, incurred in this operation, are reduced to the veriest minimum. The burnt material is removed at the end of the rotary kiln in the usual manner and is carried away by suitable conveyors, while the hot gases, leaving the apparatus and containing a certain amount of gypsum dust, are led through a suitable dust catcher where the gypsum is recovered. The product that is obtained in this manner can be used directly without any grinding being necessary.

The movement of the material through the drum is effected almost entirely with the aid of a blast of air from the fan, and this remains one of the most important advantages of the rotary kiln system of manufacturing Plaster of Paris. This feature of the apparatus makes it possible to burn gypsum of irregular particle size to a uniform burnt product. The reasons for this are as follows:

The degree of drying or rather the extent of the burning is a function of the time, during which the individual particles of the raw gypsum remain in the rotary kiln. Coarse pieces of raw gypsum will naturally not be moved to rapidly through the rotary kiln by the blast of air from the fan as will fine particles. Hence a graduated time of burning is automatically obtained for the various sizes of raw gypsum pieces corresponding accurately to their magnitude.

The regularity of the burning process is assured in this instance by the automatic distribution of the raw gypsum throughout the entire cross-sectional area of the kiln, and secondly by the automateic regulation of the burning time for particles of gypsum of varying sizes.

It is thus possible to burn gypsum which varies in particle size up to that of a walnut, something which is not possible in the old process. The gypsum does not have to be ground before being burnt,

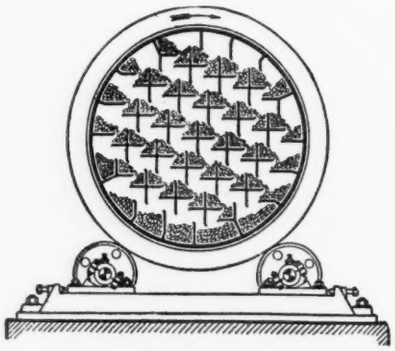


Figure One

but need only be broken up, and then the fine grinding operation is carried out on the burnt product. This means that it will take considerable less power to effect the operation, in that the particles of burnt gypsum are much more friable than those of the raw product. Furthermore, the fact that there is practically no water in the burnt gypsum reduces the consumption of power in the operation, as compared with substances which contain water,

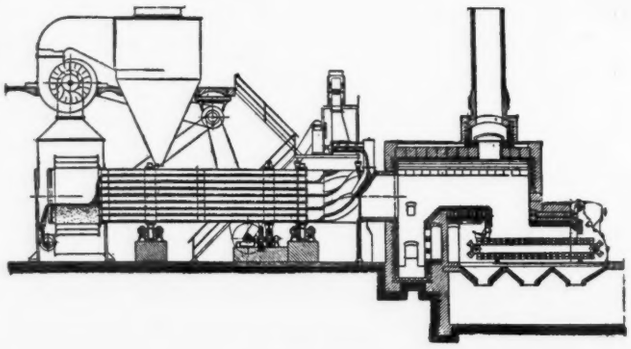


Figure Two

as will be testified by anybody who has worked with such materials.

The continuous operation of the rotary kiln is also an advantage in that no time is lost in filling and discharging the rotary apparatus, and so no heat is lost while these operations are taking place.

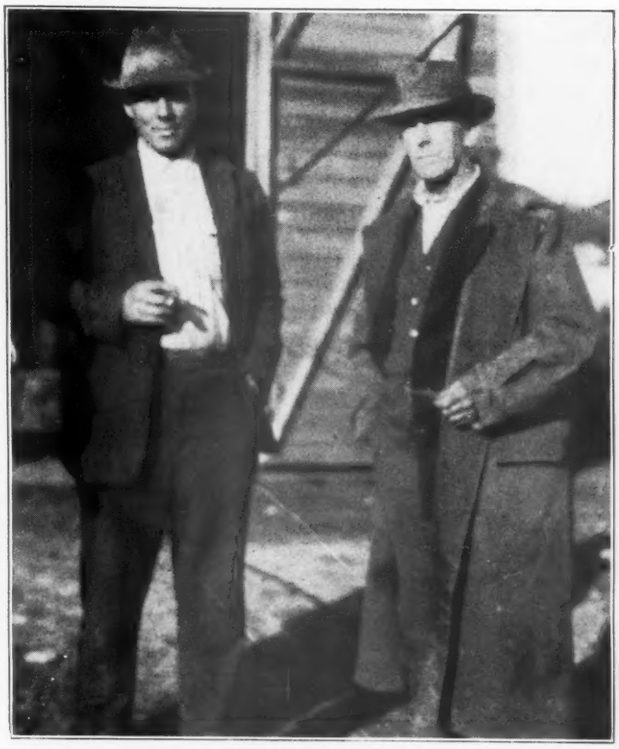
The most important saving is however due to the direct transmission of heat. Thus the conditions which surround and control the transmission of heat are much more favorable in an apparatus of the rotary kiln type, than for example in an apparatus of the boiler type, for the hot gases that are produced by the burning of the fuel, no matter what that might be, are allowed to come into direct contact with the crude gypsum in the rotary apparatus, and hence with the water contained in

(*Continued on page 91*)

NEW DU PAGE SAND AND GRAVEL PLANT SPECIALIZES IN CLEAN MATERIAL

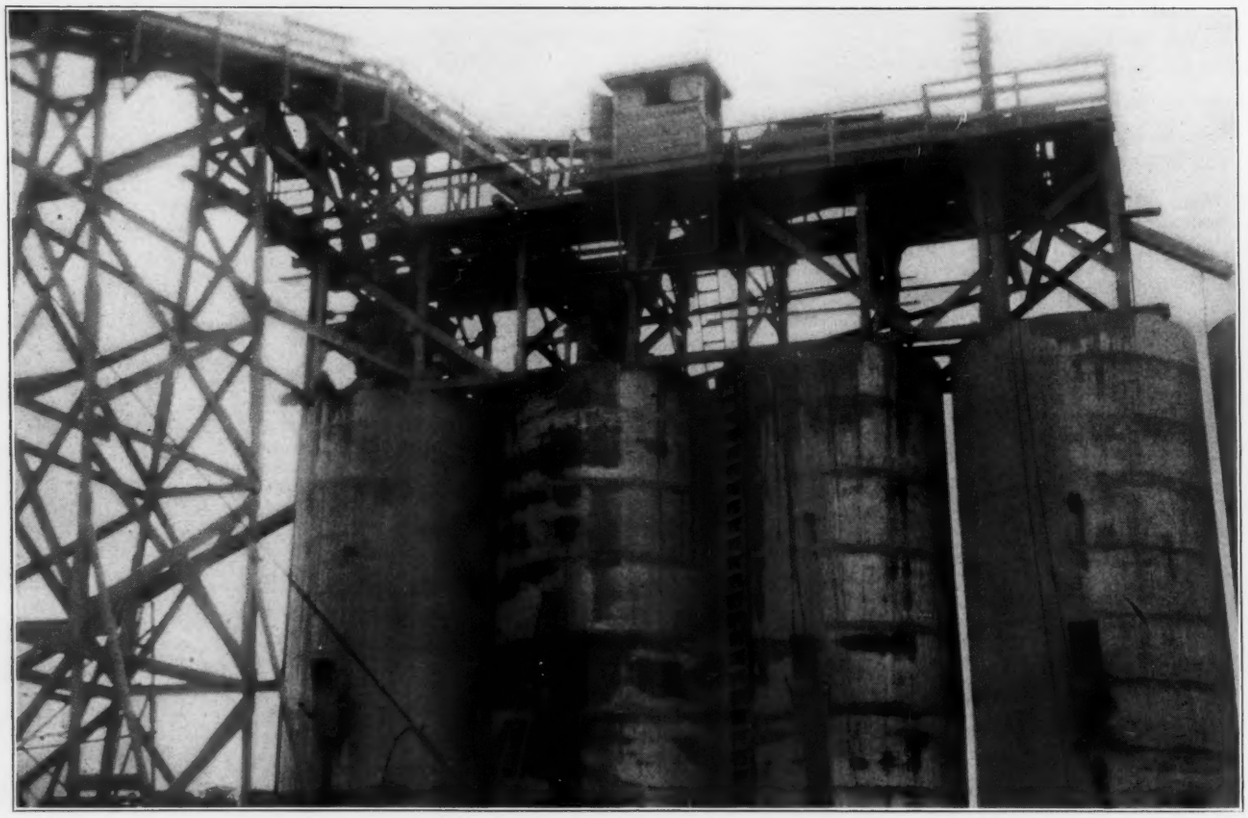
THE new sand and graval plant of the Du Page Materials Company at Lisle, adjacent to Downers Grove and Naperville, Illinois, was constructed with the idea of economically producing a clean product for local consumption and the result has certainly justified the expenditures. The plant was designed as a strictly modern, electrically driven plant and was conceived and designed by Major T. Frank Quilty, a civil engineer, ably assisted by Richard Considine, general manager. Frank Rossow is plant superintendent. The operation is now nearing its capacity production of 1500 tons per day, although the new plant only commenced operations on September 24th. Mr. Considine is operating the plant for the owners, Major T. Frank Quilty of the Superior Stone Company and Francis J. Sullivan.

The company has 80 acres under lease at the Lisle location, the present pit being about one acre in extent and largely under water as it is below the level of an adjacent creek. Overburden varies from one to ten feet, averaging about 2 feet. This is removed with an O. and S. clamshell caterpillar crane. The deposit, which varies from 30 to 40 feet in depth is excavated by means of a ¾ yard Sauerman cableway excavator operated by a two speed electric hoist driven by a 60 h. p. motor through silent chain drive. The material is hoisted from the pit a distance of about 400 feet to a reinforced concrete silo 12 feet in diameter by 40 feet

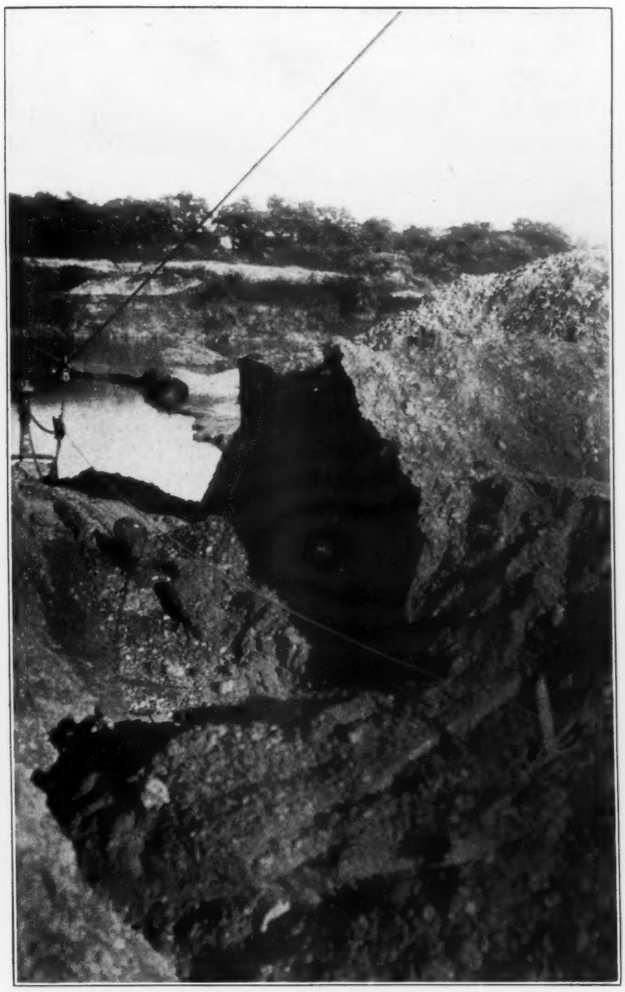


Frank Rossow, Superintendent, and Richard Considine, General Manager

View Looking Toward Plant from the Pit



Top Left, Crusher and Elevator to Scalper. Right, Screw Type Rewasher. Below, Concrete Storage Bins with Washing and Sizing Screens Above Them.

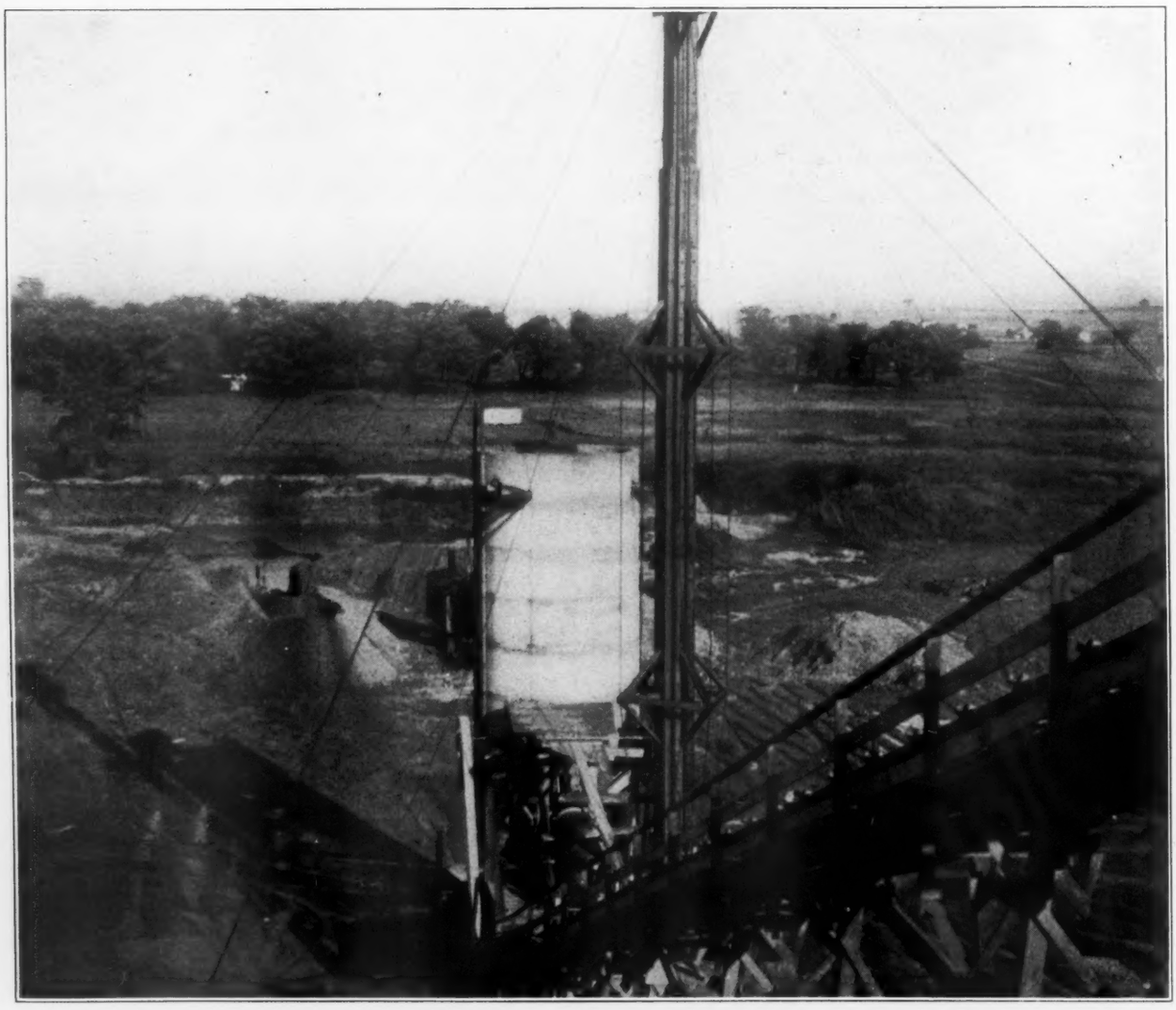


Views of the Pit Showing Operation of the Dragline Excavator

in height where it passes through a grizzly made of 60 lb. rails which rejects all the boulders over 9 inches. From the hopper the material drops out through a manually operated gate to a 40 inch by 4 feet Telsmith rotary scalping screen. The oversize rejected by the scalper drops into a number 5 Gates crusher and the crushed material is returned to the scalping screen by a Telsmith number 5 belt elevator on 25 foot centers. The through material from the scalper is fed on to a 30 inch, 177 foot centers, Telsmith belt conveyor driven by a 15 h. p. Allis Chalmers motor. A novel feature of this conveyor is that it is equipped with cleaning brushes at the bottom side of the upper pulley, preventing material from dripping down the under side of the belt, thus preventing a frequent source of belt deterioration and untidiness at the plant.

The crusher, scalper and belt elevator are all driven from a 50 h. p. Allis Chalmers motor. This is direct connected to the crusher, by shaft and belt to the elevator and by countershaft and chain drive to the scalping screen. The main conveyor discharges the material into a washing box, the water which is introduced at this point being taken from the nearby creek by a six inch double suction Allis Chalmers centrifugal pump direct connected to a 60 h.p. motor feeding an eight inch water main which furnishes 1400 gallons per minute. The material is washed through a long flume to a 40 inch by 15 feet Telsmith Ajax washing and sizing screen, gear driven by a 15 h.p. Allis Chalmers motor, the three sizes of gravel being chuted directly to their respective bins.

This washer washes out the clay balls which is a cause of trouble at many plants. When these balls are formed sand and particles of rock are picked up, giving them an armorlike coating which is very difficult to break down. The Ajax washer employs the grinding action of the larger sizes of rock to overcome this trouble. The scrubber is divided into several compartments by retainer rings which pass the small rock but retard the progress of the large aggregate. The sand, which tends to blanket this grinding action, is rapidly flushed out through perforations in the scrubber. Operating on the ball mill principle, the large rocks pound and grind the troublesome clay balls to a paste which is easily and quickly washed out.



View from Top of Plant Looking Toward Pit, Shown at Left Center

The sand and water is taken through a flume into a number 6 Telsmith automatic sand settling tank which takes out the number 2 or torpedo size sand, the fines passing in the overflow to a number 7 Telsmith automatic sand settling tank which removes the number 1 sand. The sized sand from each of these settling tanks is discharged into two Telsmith screw type sand rewashers and is then chuted into bins.

There are five silos or live storage bins of reinforced concrete, 16 feet in diameter by 34 feet high which load on either side to trucks by means of 16 by 18 inch Telsmith quadrant type truck loading bin gates. Since these bin gates are about 10 feet up on the silos the live storage capacity is about 75 cubic yards per bin.

Permanent storage is now being handled by allowing the respective sizes of sand and gravel to flow out of their respective bins to the ground where they are picked up by an Orton and Steinbrenner crane equipped with a one yard bucket and dumped into their respective storage piles. Waste waters containing the silt and clay from the washing operations are conveyed by flume to a settling hole on the property. This hole is 30 feet square by 20 feet deep the overflow being conveyed by open ditch back to the creek.

The production of the company includes three sizes of gravel and two sizes of sand, that is, No. 9 gravel or 1¼ inch to 2½ inch; No. 8 gravel or ⅜ inch to 1¼ inch; No. 5 gravel of ¼ inch to ⅜ inch; No. 2 or torpedo sand and a finer sand called No. 1.

The company intends to serve retail dealers in the suburban towns of Lisle, Downers Grove, Westmont and Hinsdale which are adjacent to Chicago and also to bid for furnishing material to some of the extensive road building jobs which are being planned in the immediate locality.

(*Continued from page 86*)

that gypsum which must be removed by evaporation. In this connection the arrangement of cross-shaped plates within the rotary kiln is of great importance, for these plates distribute the contents of the apparatus in a uniform manner over its entire internal area with the result that the surface which comes into contact with the hot gases is as large as possible. Furthermore, it is evident that when the rotary kiln rotates the contents are turned over and this allows the heating gases to come into contact with fresh masses of material. When the particles of gypsum fall from one cross-shaped plate to the next, it falls through an atmosphere of hot gases which surround it on all sides and hence the heat interchange that takes place is accomplished under the optimum conditions.

Absorption of Salts by Colloidal Clay

The absorption of positive ions by clay appears to be constant and independent of the kind of ions. When a mixture of salts is used an equilibrium is established between the various ions present. For example, potassium and ammonium ions are fixed in equivalent proportions, and the absorption of sodium ion is retarded in the presence of these two. Calcium ion decreases the absorption of the alkaline ions to an extent depending on its concentration. Selective absorption can be obtained by varying the concentration of these four ions. Demolon and Barbier (Compt. rend. 1927 *185*, 149-150).

Influence of Hardening Temperature on Aluminous Cement Mortars

Test pieces made of aluminous cement were placed in wet steam for the first 24 hours hardening, at a temperature of 88 degrees C. They showed on an average, after this interval, a tensile strength of 612 lbs. per sq. in. They were then cured under water for 28 days, at a temperature of 16 degrees C. After 7 days the tensile strength was 654, after 28 days, 665 lbs. per sq. inch. The corresponding figures for hardening over water at 61 degrees C. were 595, 611 and 675 lbs. per sq. inch. The crushing strength tests show similar results. The conclusion reached is that a rapid heating with subsequent curing at a low temperature has much less deleterious effect than long slow heating to the same temperature. Roscher Lund (Zement, August 25, 1927. 747-749).

English Aluminous Cement

The English variety contains 35-50% lime, 30-50% alumina and not more than 20% silicic acid, iron oxides and all other constituents. It has a dark almost black color. Concrete made from it is darker than that from Portland cement. The process of manufacture consists of mixing bauxite lumps, burned lime or limestone, in predetermined ratio and melting the mixture either in a rotary kiln or a blast furnace. The melt is cooled and ground to an impalpable powder. As bauxite does not occur in England, and must be imported, the manufacturing cost is very high. A. C. Davis (Zement, August 25, 1927. 749-753).

Acid Proof Hydraulic Cements

Barium sulphate mixed with sand, clay or other silicates is burnt to the sintering or fusion point, preferably with an admixture of coal or coke. The percentage of barium aluminate formed is kept low, and a proportion of aluminum silicate or iron oxide is formed. The ground product is highly resistant to acids and sulphates. This resistance can be increased by treatment with a sulphate solution. Portland-Cementwerk Ballinger G.m.b.H. (British Patent 269, 549).

CRUSHERS AND THEIR COMPONENT PARTS

Wm. T. W. Miller

Part VIII

PARTS one to seven, inclusive, of this series of twelve articles have appeared in the past seven numbers of Pit and Quarry. In them, Mr. Miller described mechanisms applied to jaw crushers, jaws and cheek plates for rock crushers, toggles and toggle bearings, lubrication and the development of the gyratory crusher. In the eighth article which begins below Mr. Miller takes up the subject of roll shells and centers for crushing rolls.

Mr. Miller, the author of this series, has had thirty years' experience as a specialist in crushing machinery. For the last twenty-six years he has been employed by Hadfields, Ltd., of Sheffield, England. For the past eighteen years he has been engineer-in-charge of their crushing machinery department. He has studied crushing problems in the United States, Canada, Brazil, Uruguay, Argentine, France, Spain and Portugal.—Editor.

Roll Shells and Centers for Crushing Rolls

Since the days of the early Cornish rolls there has been a gradual development in the construction of the rollers, the original simple form of roll having almost entirely given way to a composite design made up of various materials and held together in varying ways to meet the special conditions under which the rolls may have to work. When rolls were first used the rollers were made of cast iron and consisted of a hollow cylinder with a square or hexagon hole, as shown in Fig. 1., which was made somewhat larger than the seating on the shaft to permit of the insertion of oak or iron wedges to secure the shell in position and, at the same time, allow of it being set true with the shaft.

With the exception that the holes are now bored to fit on a turned shaft, rollers of this type in cast iron with chilled or hardened crushing faces are still used by some of the leading makers when the material to be crushed is not of a nature to cause excessive wear and tear on the roll surface. The fact that these semi-solid rollers had frequently to be scrapped after only a relatively small amount of metal had been worn away quickly led to the introduction of a roller made in two parts, with a thin renewable outer wearing ring and a permanent core or center to which it was secured.

One of the earliest forms of the compound roller is illustrated in Fig. 2. The renewable jacket was made of a thickness which would permit of a reasonable amount of wear before the shell had to be replaced and it was secured to the core by means of several driving lugs fitting loosely into recesses in the cast iron center. The internal diameter of the shell was greater than the external diameter of the core and after being lightly wedged to make it revolve true with the shaft, the cavity was usually filled with spelter, or, as shown in Fig. 3, oak and iron wedges were driven into fill the spaces and make the shell fast on the center.

This type of fitting is still used with success in rolls of small diameter and is found to be an economical system of construction when it is desired to avoid machining the shells. As the jackets wear thin they are liable to stretch and come loose causing the spelter to break away and the keys to work out sideways, but it is a simple matter to refix the shells and in many cases this can be done without removing the shafts from their bearings.

Slow-moving rolls of the Cornish type are still used by a large number of quarries in England for the secondary crushing of roadstone for macadam and in these machines the shells are frequently made in two or three sections in the length of the rolls. There is always a tendency for the wear to be concentrated near the center of the roll and this system of dividing the shells enable the sections to be changed around to balance this irregularity.

The ring-sections are a loose fit on the center but are prevented from turning by three or four continuous lugs which slide in longitudinal grooves or recesses in the core and the shells are held in place sideways by heavy washer-plates which are cottered to the shaft at both ends as shown in Fig. 5. The lugs or internal ribs are usually about one and a quarter inches square in cross-section and each bears for the full width of the ring but with a working clearance of approximately three sixteenths of an inch on the diameter the chattering action quickly eats away the recesses in the iron or steel core and, unless means are adopted to compensate for this, the center is quickly destroyed. To overcome this trouble hard steel wearing pieces are fitted into the center, as shown in Fig. 6, and these can be made to project above the body of the core and serve to restore the diameter when this is reduced by wear.

The renewable shells shown in Figs. 2, 3 and 5, are made in the form of castings in either chrome or manganese steel and in each case the method of fitting is sufficiently elastic to permit of rough castings being satisfactory without any machining. When the rolls are to be used for relatively fine crushing, where the shells must be of such accuracy that a machine finish is essential, the construc-

tion shown in Fig. 4, has proved both economical and serviceable.

The core is of cast iron, pressed and keyed on the shaft, turned on its outside diameter to form a portion of a cone with an included angle equal to a total taper of one inch or one and a half inches per foot. A series of longitudinal grooves are cast in the surface of the cone to receive the hook bolts which are used to draw the shell on the center, and the heads of the bolts are buried in recesses in one end of the shell which can be machined both inside and outside if required.

Fig. 7, illustrates the type of composite roll which is generally adopted for high-grade machines. The core is made in halves, one half being a fixture while the other is free to slide either on the shaft or on a boss-extension of the fixed center. The jacket is machined inside to form double conical bedding faces, and the loose center has to be entirely removed before the shell can be placed in position, but when the elements are assembled the two cores are drawn together by through bolts, the wedge action depending on the taper of the cones.

There is no definite standard for the angle of the cones, which will, in fact, be found to vary considerably in machines built by different makers, the single taper may range from three-eighths of an inch per foot up to three quarters of an inch per foot, the former gives an angle of two degrees form the horizontal which is gradually being accepted as a standard for large rolls.

This finer taper is naturally more effective in gripping the shell to the center than the coarser inclines, but it makes it more difficult to separate the cones when the parts have to be removed, and it also requires a very small irregularity in machining to displace the shell sideways an appreciable amount on the fixed center.

To assist in the process of separation of the cones a series of holes are drilled and tapped in the loose center and pinching screws are used to press the cores apart. Although the sections are apparently held together very securely, when the taper of the cores is reduced to the extent indicated, there are several disturbing influences at work besides the torque due to the transmission of the power from the shaft to the surface of the shell.

There is always a certain amount of heat generated in crushing and, if the rolls operate at high speed on hard ore, the shells get warm and may easily reach a temperature sixty or seventy degrees higher than that of the atmosphere. This local heating causes the shell to expand and become loose on the centers, and to overcome this trouble it is becoming a very common practice when assembling the roll to heat the shell to a temperature about one hundred degrees F. above that reached in work, and expand the bolts in a similar manner before the centers are drawn together.

It frequently happens that stone or ore, escaping between the side cheeks and the rim of the shell, causes wear on the edges at right angles to the crushing face, the centers are not always flush with the shell which becomes burred over the core to such an extent that it is almost impossible to get them apart. This can be avoided by bevelling slightly the internal edges of the fitting faces. As previously stated conical fitting is usually applied to shells which are machined inside to gauges, but there are one or two tightening devices on the wedge principle which are applicable to unmachined castings.

Fig. 7, illustrates a combination of this kind used in the manufacture of small rolls by a well-known English maker. In this case the shell is parallel inside with three driving lugs running the full length, the shaft is formed with a solid center of triangular cross-section having double inclined planes, and six loose wedge-blocks with part-circular outer faces complete the component parts.

The wedge-blocks are drawn together by through bolts and, by careful adjustment, it is possible to compensate for inequalities in thickness of the shell and ensure true running of the crushing face of the roll. In this case the shell is held sideways merely by the friction between the matching faces as the wedge-action is confined to the inner joints. The construction shown in Fig. 8, is similar to that just described, except that the shell is made more secure by the double taper wedge-blocks and the shaft forging is simpler and easier to machine.

Fig. 10, illustrates a rather elaborate composite fitting which includes a self-tightening center on similar lines to the well-known Blanton fastening used in many stamp batteries. The core is made in the form of a three-pointed cam and the six wedge-blocks are shaped internally to bed on the parallel faces of the shaft-center whilst their outer curves are tapered to correspond with the double conical inner surface of the shell. The shaft must be inserted in the mill to revolve in a given direction so that the blocks are driven up the cam-inclines and expand outwards to grip the shell. The parts are difficult to machine and there is no positive centering device for fixing the roll in position sideways. This construction does not appear to have progressed beyond the experimental stage.

Referring once more to the type of roll, indicated in Fig. 5, in which the renewable shell consists of a series of ring sections which are not machined or ground true inside, a very clever self-tightening center is used in some of the Welsh quarries, as shown in Fig. 11, which almost entirely eliminates the excessive wear inseparable from the more primitive design.

The shell comprises two similar ring-sections and the body of the shaft is enlarged to form the solid center for the roll with a middle collar which divides the intermediate locking device into two

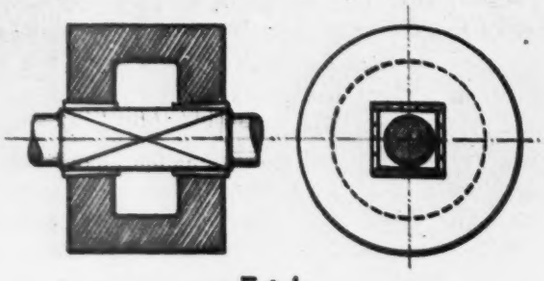


Fig. 1.

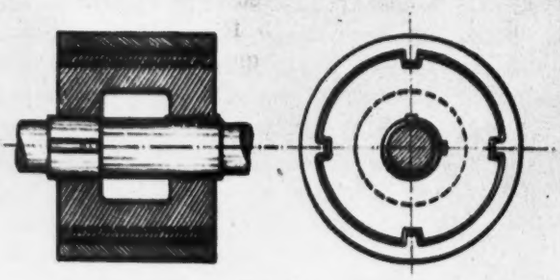


Fig. 2.

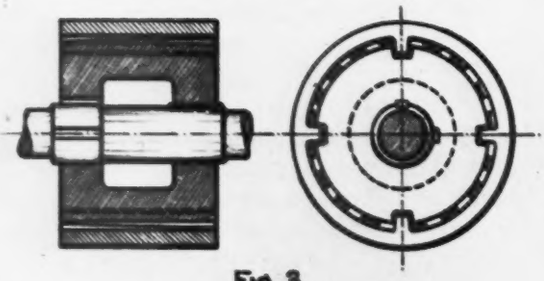


Fig. 3.

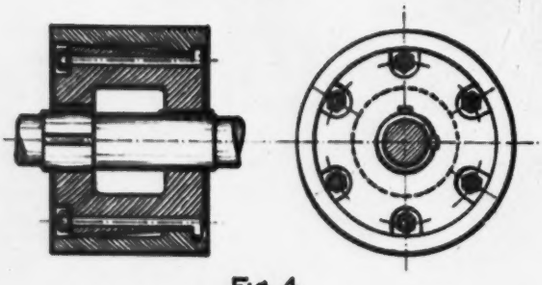


Fig. 4.

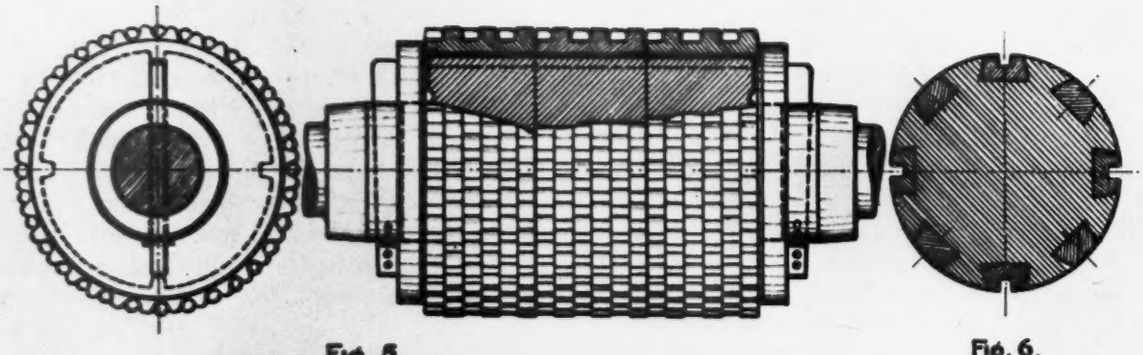


Fig. 5.

Fig. 6.

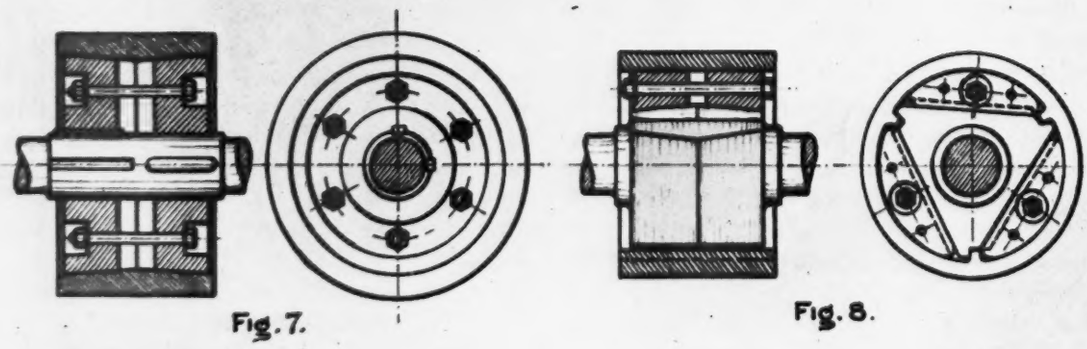


Fig. 7.

Fig. 8.

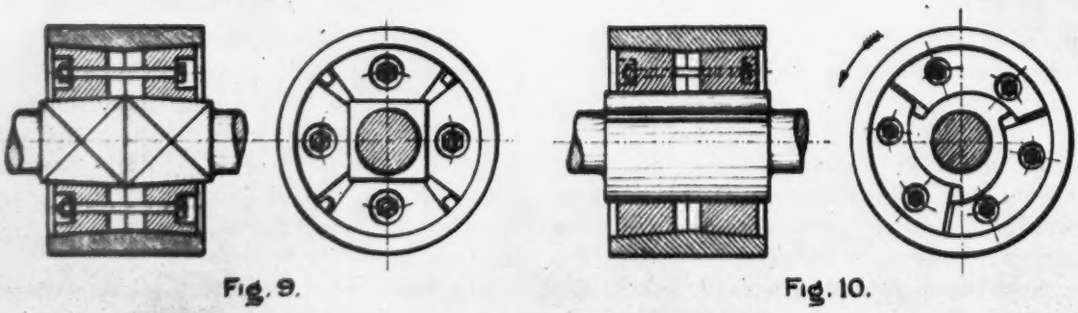


Fig. 9.

Fig. 10.

equal series. The wedges consist of a number of overlapping expansible and contractible rings of triangular section which are cut across to allow them to open and close and arranged to loosely fill the spaces between the shaft and the inside of the shells.

Flanged collars, having right and left hand threads, are screwed on the shaft and are brought to bear against the outermost rings on each side of the center. The shells have driving lugs which engage in slots in the end-collars so that, when the roll is correctly placed, any independent rotation of the crushing surface causes the collars to draw together and forces the rings in contact with the shells and the body of the shaft until the turning movement ceases and the roll rotates as a solid member.

Although expensive in first cost this contrivance has proved thoroughly effective in service and possesses one great advantage in that it is possible with this device to use manganese steel shells without any internal grinding. Rough castings will naturally vary in dimensions and the internal diameter may change from end to end of the same shell but the divided character of the wedge-rings compensates for all irregularities of this kind and ensures a rigid bed which eliminates the chattering so destructive to the surfaces. When the rollers are made in the form of continuous shells the rings can only be removed from the driving shaft by lifting the complete roll out of its bearings and uncoupling or dismembering the parts in some more accessible position. The larger the rolls the more difficult the problem of handling the various details which make up the composite roller.

A number of years ago an attempt was made by the firm of Humboldt in Germany to overcome this difficulty by splitting the roll shell in halves horizontally and making the centers in such a way that they would lock the half-rings in position as shown in Fig. 12. By slacking back the sliding center a sufficient distance to free the dovetail internal fitting-ring the half-shell could be removed without lifting the roll. Although ingenious this fitting did not prove very successful, as the jonts in the plain shells tended to flatten or hammer out under the crushing pressure, and the combination was ultimately displaced by solid ring shells on conical centers.

For coarse crushing the presence of the joints does not give serious trouble, especially when the surfaces are corrugated, and the great advantage to be gained by fitting renewable plates has led to the introduction of various designs in which the crushing surface of the roller is divided into sections each comprising a segment of the circle.

These crushing plates are made in various forms and secured by different means, Fig. 13, illustrates a sectional shell which is used very largely in coal crushing rolls. The plates are held to the backing by two bolts at either end, in some cases a driving lug is cast on the inner surface of the plate which fits in a recess in the center but, in small rolls, the bolts are the only stops needed to prevent displacement of the roll sections.

Fig. 15, shows a more elaborate type of plate fitting used on rolls of large diameter, the segments are made in manganese steel with a backing of spelter where they bed on the center, each section has two rectangular lugs with cored holes for the cotter-bolts and two shallow projections which act as keys to prevent circular movement.

The lugs enter into deep pockets in the body casting and the cotter bolts are inserted through the central cavity with the nuts outside so that, by screwing the bolts tight, the plates are secured to the circumference of the center. In the large rollers of the high-speed coarse crushing mills of the Edison type the same idea is carried out in another way which is made clear in Fig. 14. The core is usually octagonal and built in three ring-sections which are pressed on the shaft to form a solid center. The plates are machined on their bedding faces and on the tongues which fit into longitudinal keyways and they are secured to the center by means of a number of strong set-screws with special heads buried in deep circular recesses in the crushing face of the plate.

The screws are prevented from slacking back under the hammering action by locking plates. In the largest rolls, which reach six feet diameter by seven feet wide, the sections are divided into one long and one short plate in the width of the roll and the joints are alternated to avoid grooving. When rolls are used for fine crushing the shells must, of necessity, have smooth surfaces but for coarser products, above three quarter inch cubes, corrugated or toothed shells may be fitted with beneficial results.

The advantages obtained by indenting the surface of the shell are primarily a better grip on the material being crushed. This in itself is of great service, making it possible to nip relatively large pieces with rolls of small diameter, and secondly, corrugations or teeth of chequer-board pattern give a more regular and cubical product as the breaking surface is reduced in area taking the form of a series of rounded hammer points instead of plant contact areas. Toothed rolls give freer breaking with less power than smooth rolls since a great number of the flat stone are broken as beams carried on supports with cavities under the breaking points.

The disadvantage of corrugated or toothed rolls may be summed up in a few words, the life of the shell is limited by the durability of the teeth or corrugations, and as soon as these are worn down the crushing surface must be renewed. Their

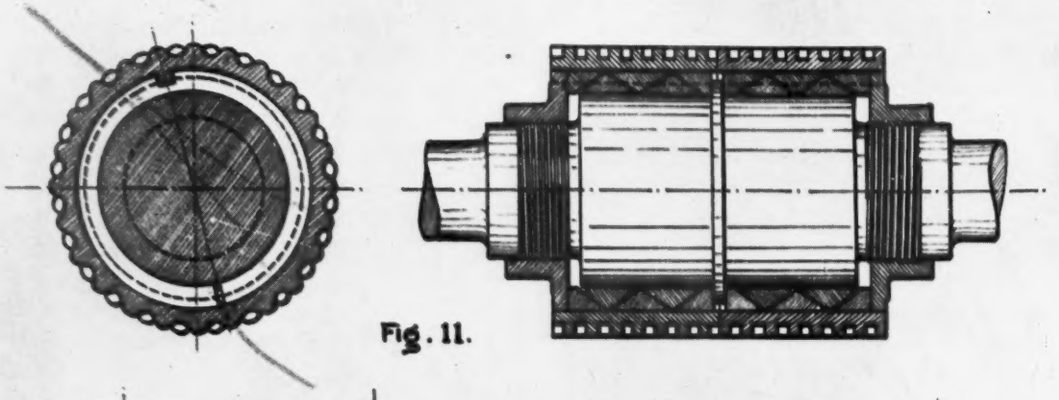


Fig. 11.

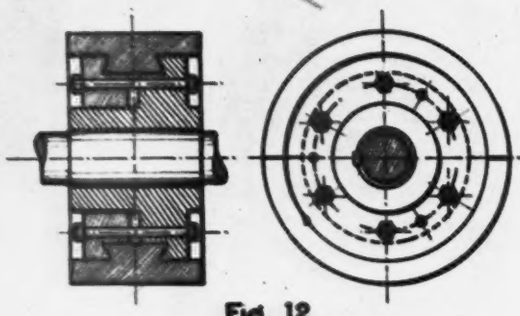


Fig. 12.

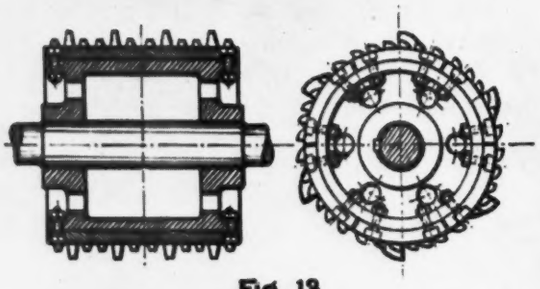


Fig. 13.

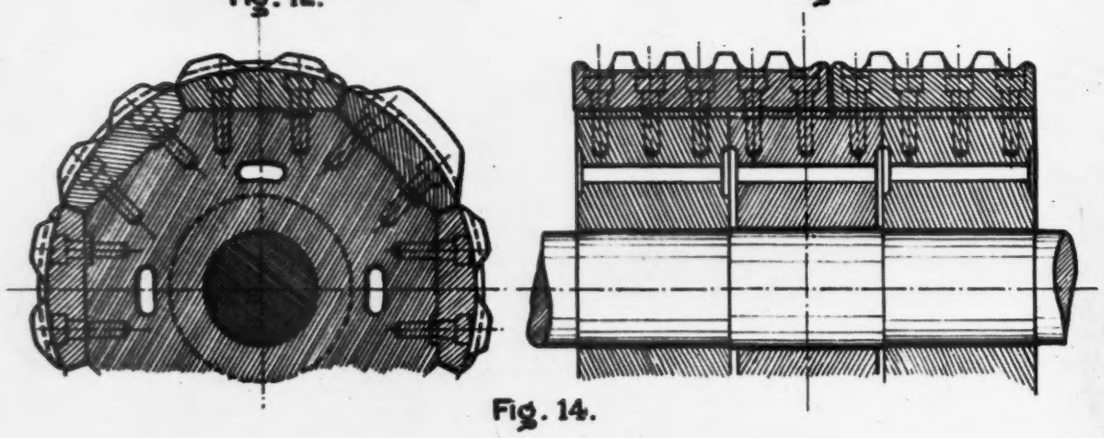


Fig. 14.

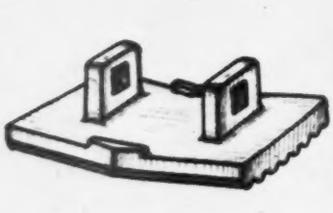


Fig. 15.

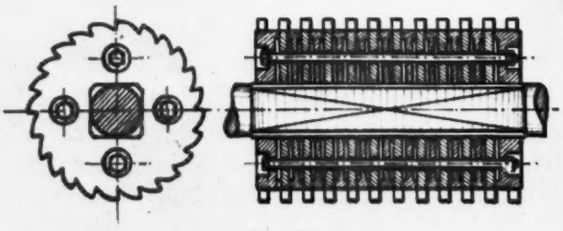


Fig. 16.

Fig. 17.

Fig. 18.

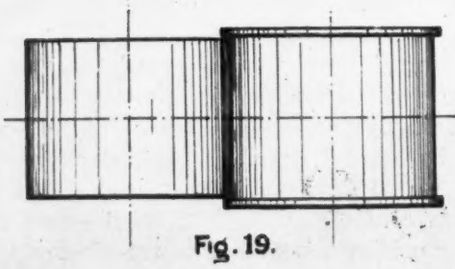


Fig. 19.

period of usefulness is restricted by the fact that as the contact area is reduced so the rate of wear increases and corrugated shells do not last as long as those with smooth surfaces. As previously stated toothed shells can rarely be used for the finer products and the smaller the teeth or corrugations the less durable do they become.

The simplest construction for the indented surface is the straight horizontal corrugation, the contour being determined by the nature of the material being crushed and the size of finished product required, when both rollers are driven by separate belt pulleys it is usually not practicable to make tooth and cavity mesh on opposing rolls, but this is sometimes attempted when the rollers are coupled together by involute gears. Occasionally the indentations are shaped like the teeth in a double helical gear-wheel and with this construction the corrugations may be made to cross each other at the crushing zone, the roll surfaces breaking up into opposing diagonal lines which are very effective reducing media.

It is sometimes advisable, in order to avoid making the corrugations of such small proportions as to render them ineffective, to run one plain and one toothed shell to make a pair, by this means it is possible to gain some of the advantages of the corrugated roll without incorporating a wasteful design of shell in the combination.

Very occasionally the rolls are made with circumferential corrugations, the grooves on one roller being opposite to the ridges on the other. This formation is useful in breaking up thin flats or flakes which are liable to pass smooth parallel faces, but the gripping power of the shells appears to be decreased and the rolls will not take so coarse a feed as when fitted with smooth shells.

When the corrugations are subdivided into a series of small projections the shape, disposition, and dimensions of the teeth are of infinite variety. Not only do the proportions depend on the character of the material being crushed and the work which the rolls are called on to perform but the material of which the teeth are made has an important bearing on the design, tooth-forms which are practicable for manufacture in some of the special alloy steels are quite unsuitable for hard cast iron. When the teeth project beyond the surface to any considerable extent they are liable to be damaged or broken off should a piece of uncrushable material pass between the rolls and it is therefore of some value to be able to repair the damage without replacing the entire shell.

In some instances the teeth are made separately and inserted into the body of the roll in such a manner that they can be removed and replaced as they become worn out without renewing the shell as a whole. Fig. 17, shows teeth of this type, such as are used for crushing coal and oil-bearing shale, the projections are claw-shaped and the round taper shanks are machined to a driving fit in the holes in the body of the roller.

Fig. 18, illustrates a more complicated system of fastening for inserted teeth in the large rolls used for the crushing of fluxing limestones and cement shales. The teeth are forged of rectangular section with a projecting toe at the base which fits under a ledge in the pocket to prevent the tooth from rising, they are laid in the prepared cavities and secured by taper keys which are driven into the free spaces at the back of the teeth. The keys are also locked by set screws.

Rolls of small diameter with serrated teeth are sometimes built up of narrow ring sections or discs threaded on a square shaft as shown in Fig. 16. This design is commonly used in rolls for breaking down green bones for the making of glue and the saw-shaped discs are inter-leaved with plain rings which provide free grooves for the passage of the teeth on the opposite roll. With this construction the toothed discs may be made in manganese or oil-hardened steel while the intermediate plain discs are cast in some less expensive material. It is also possible, in case of accident, to remove the damaged parts without discarding the complete roll.

Every mill-superintendent using smooth rolls for fine crushing is familiar with the deformation known as "flanging" of the roll-shells. "Flanging" may take the form of a thin rim of unworn or partly-worn metal which is left standing on one edge of the shell, a similar rim being left at the other end of the opposite roll. Single flanges of this kind are due to inaccuracies of alignment between the opposing roll faces, caused either by incorrect placing of the centers on the shafts or by the shells fitting unequally on the cores, or, in some cases, by irregular side-wear on the bearings.

There is another kind of flanging which is very difficult to avoid even when the shells are correctly aligned and this is due to coarse material fed to the rolls being crowded away from the extreme edges by the action of the side cheeks which are fitted to prevent the escape of uncrushed particles.

To overcome or minimize these "flanging" troubles some manufacturers provide appliances for adjusting the rolls sideways at frequent intervals. In small mills where such devices are hardly applicable the shells are frequently made with bevelled edges to delay as long as possible the appearance of the flanges, although it must be admitted that, when the shells are new, a proportion of oversize is allowed to escape at the outer edges of the rolls.

Some mill men favor the use of one double-flanged and one plain roll as shown in Fig. 19. This combination relieves the bearings of all side-thrust and the plain roll penetrates into the wider surface of the flanged roller as wear takes place, but the delaying action at the sides of the rolls is

still present and the shells wear hollow in the center.

In some instances it will be found advantageous to make one roll in a different quality of steel to the other. The writer has known several cases where one hard and one softer roller are used together and the shell which wears out first is frequently that made in the harder steel as the material being crushed appears to be driven into the softer face as into a cushion and the grinding is done by the harder roll. In the early days of the roller crushers the wearing faces were made in cast iron and this material is still used for dealing with soft and semi-hard products. For the harder work the faces of the rolls were chilled to increase their resistance but great care had to be taken to avoid brittleness.

For the composite rolls the shells are usually made of cast or forged steel and the centers of cast iron. If a machine finish is essential the material for the shells may be either a high-carbon steel or an alloy containing one or two per cent of Chromium. Manganese steel is admirably suited for shells which are required for crushing hard and abrasive ores if the finished product is not so fine as to make it necessary to true up the roll faces at frequent intervals.

The advantages of the various steels may be summarized as follows: Rolled or forged shells in either high-carbon or chrome steels give the best results as regards uniformity in structure and freedom from porosity and soft places, but they are rather costly. Cast steel shells in either of the above qualities, if made by a good foundry, will usually prove reasonably satisfactory, the difficulties with the castings are, uneven density across the wearing face due to the position of the feeding heads, and blow-holes or spongy places in the vicinity of the heads. With ample heads and careful treatment trouble from the above causes can be reduced to a minimum.

Cast manganese steel shells cannot be machined in the ordinary way but require special grinding appliances for this purpose. The exceptional wearing properties of this steel have made it increasingly popular for rolls which are subjected to excessive abrasion. It is, however, not suited for every kind of crushing, the alloy is essentially a ductile material and the hard face is artificially produced under work. It is liable to spread or become distorted under repeated hammering but where this difficulty can be overcome it will be found eminently serviceable for coarse and medium crushing rolls.

The roller crusher has always been considered a simple piece of mechanism and, although this is true in principle, the details offer scope for the exercise of considerable ingenuity so that, whilst the foregoing remarks are rather sketchy, they may prove of service to some of the many users of crushing rolls who are desirous of making improvements in their plant.

Carborundum Surface on Concrete

In order to get a non-slippery floor a carborundum surface is often advisable. This also darkens the concrete and makes discoloration by oil less noticeable. The carborundum powder is sprinkled through a sieve on to the wet concrete using between 1 and 2 pounds of concrete according to the degree of roughness desired. The powder is lightly rolled or pressed into the surface of the concrete, taking care not to force it below the surface. Editor (Conc. & Const. Eng. Sept. 1927. p. 545).

Aluminous Cement

Aluminous cement is prepared by heating an intimate mixture of iron-bearing bauxite and lime or limestone, each ground so that at least 90% passes the 180 mesh sieve, to a temperature below sintering, about 1,000-1,100 degrees C., for about 6 hours. The following limits for the constituents are given: Silica 0-5%, Iron oxide 10-25%, alumina 40-55% and lime 20-40%. Soc. Anon. des Chaux et Ciments de Lafarge, etc. (British Patent 250, 246).

Concrete Impervious to Oil

The usual method to proof concrete to oil is to treat it with silicate of soda. The method is to apply a solution of silicate of soda diluted with 4 parts of water over the face of the concrete with a brush or broom, after it has hardened. It is necessary to brush it continuously over the surface for several minutes to obtain an even penetration. This application is repeated three times. Editor (Concrete & Const. Eng. Sept. 1927. p. 545).

Cooling Cement Clinker

A rotary cooling drum for cement clinker has its length only slightly greater than its diameter and is rotated at about 25 R.P.M. so that the material is carried around with the drum. The latter is lined for a portion of its length with fire-brick and is driven by a gear. The cooling is effected by a current of air supplied by a fan, a perforated screen being provided to equalize the blast over the whole cross-section of the drum. Allen & Co. and J. W. Coles (British Patent 274, 656).

Artificial Stone

Raw or calcined magnesite is heated with a flux such as sodium silicate or borax, to the sintering point and the ground product is gauged with a solution of magnesium aluminium and barium chlorides. Abrey (British Patent 273,989).

PRINCIPLES OF DEPRECIATION

Determining When Equipment Should Be Scrapped

J. J. Berliner

DEPRECIATION may be defined as the reduction in value of an asset at a given period of time, as compared with value at a previous period of time. This shrinkage in value may be the result of obsolescence; inadequacy; extent of time; or wear and tear. Depreciation may be further classified as to being either: (1) external; (2) internal. It is external when it is caused by influences outside of, and apart from, the asset itself, such as for example, obsolesence or inadequacy. It is internal when it is caused by a natural law such as wear and tear, such as results, for example, when a machine is in use.

Obsolescence

The problem of obsolescence is a very important one. At some time or other, the question arises whether or not to scrap a unit or part of the equipment. Many plant executives have scrapped machinery where it was unprofitable to do so. On the other hand, many have failed to scrap machinery where to do so would have been profitable.

A machine is effectively obsolescent when production can be carried on more cheaply by replacing it with an improved one, after adding in the original cost of the old machine (less its scrap value and less the actual physical depreciation to date) to that of the new machine. How to calculate whether a unit is obsolete or not, can be best demonstrated by taking a typical problem. Let us assume the following case:

A machine purchased three years ago, cost $2,400. Its cost of operation (labor, power, etc.) is approximately $2,100 per year. The total life of the machine is estimated at six years. At present, there is a greatly improved machine, with a slightly larger capacity on the market. Because of its ease of operation and lower costs, through improvements in the machine, the cost of operation is reduced to $1,600 per year. The cost of the new improved machine is $4,000. Should the old machine stay in operation, or should it be scrapped and replaced by the improved machine?

To answer this problem, there are two elements entering into the cost of production to consider: (1) the unrecovered investment; (2) the operating expenses, which consist of items such as gas, power, labor, etc. By unrecovered investment is meant the original cost of the machine, less the actual depreciation. In the case of the old machine, the unrecovered investment is determined thus:

Cost of old machine	$2,400.00
Estimated scrap value at end of 6 years	100.00
Amount to be depreciated over life of machine six years	$2,300.00
Depreciation for one year—$2,300 ÷ 6 =	383.33
Depreciation to date (three years)	1,150.00

Putting the above data in concise form, matters stand as follows:

	Unrecovered Cost	Old Machine	New Machine
Cost	$2,400.00	$1,250.00	$4,000.00
Depreciation	1,150.00		
Current Operating Costs	2,100.00		1,600.00

If money is worth 6 per cent, the capital cost of operating the old machine is: $2,100 ÷ .06 = $35,000.00. That is, if the operating expenses are capitalized, it is equivalent to a capital investment of $35,000. On the other hand, the capitalized cost of the new machine is $1,600 ÷ .06 = $26,666.07. Adding the capitalized costs to the original costs of the respective machines, we have the following:

Old Machine

Original Cost less depreciation	$ 1,250.00
Cost	$2,400.00
Depreciation	1,150.00
	$1,250.00
Capitalized operating cost	35,000.00
Total Capitalized cost	$36,250.00

New Machine

Original cost	4,000.00
Capitalized Operating cost	26,666.67
Total Capitalized cost	$30,666.67

From the above illustration, it is evident that a substantial saving would result if the old machine were scrapped. If we scrapped the old machine, our loss on the old machine would be ($1250, less scrap value $100) $1150. Adding this loss to the total capitalized cost of the new machine, would give the final cost of $30,666.67, plus $1150, or $31,816.67 as compared with the total cost of the old machine of $36,250. By scrapping the old machine, there would be a saving of $36,250, less $31,816.67 or $4,433.33.

Inadequacy and Replacement

The problem of inadequacy and replacement is one very similar to that of obsolescence, but differs in this respect: the question of inadequacy is one of size and power, while that of obsolescence is one of type and quality.

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When a given machine becomes inadequate, the problem then arises whether it is cheaper to add another unit of the old machine type, or whether it is cheaper to scrap the old machine, and purchase a new one, with a larger capacity. Let us assume the following facts:

A machine with a capacity of 30 units per hour has been in operation for two years. This machine is now inadequate, insofar as it is desired to increase the capacity to 60 units per hour. The cost of an additional 30 unit per hour machine is $1,300; that of a 60 unit per hour machine is $2,000. The life of the old machine is estimated at five years, and the amount of depreciation to date is estimated at $468. Assuming that the operating costs are approximately the same for both machines, we have the following facts:

Old Machine

(Cost less depreciation)	
$1300 — $468 =	$ 832.00
New machine of same capacity—Cost	1300.00
Total cost of two machines	$2132.00

New Machine

60 unit per hour—Cost	$2000.00

From the above illustration, it is evident that it is more economical to add another 30 unit per hour machine, than to scrap the old machine and substitute a 60 unit per hour machine. For, if the 30 unit per hour machine were scrapped, matters would stand as follows:

New machine (60 units per hour)		$2000.00
Old machine (30 units per hour)	$832.00	
Less scrap value	130.00	
Loss on old machine if scrapped		702.00
Total cost of new machine		$2702.00
Total cost of two—30 unit per hour		
Old 30 unit per hour machine	$ 832.00	
New 30 unit per hour machine	1300.00	
Total		2132.00
Loss if old 30 unit per hour machine were scrapped		$ 570.00

Internal or Physical Depreciation

In estimating the physical depreciation of an asset, the following factors are to be considered: (1) life of asset (2) cost (3) residual value (4) extent of repairs and renewals during life of asset. There are a number of methods used to calculate depreciation and these are as follows:

1. Equal or Fixed Annual Installment Method—Each year's revenue is charged with the actual cost of repairs and small renewals, and in addition, with an equal fraction of the original cost of the asset. A fixed percentage of the original cost is charged to revenue each year so as to reduce the asset to scrap value at the end of its life. Repairs and renewals are charged to revenue as they occur.

The annual depreciation charge is calculated by simply taking the cost of the asset, less its estimated scrap value, and dividing. This charge is debited to the nominal account known as "Provisions for Depreciation" (this account being later closed into a profit and loss account) and credited to the account known as "Reserve for Depreciation," or it may be credited directly against the asset.

ILLUSTRATION OF METHOD 1.—A plant cost, say $50,000 on January 1, 1920. Estimated life 10 years. Value of plant as scrap at end of 10 years—$5,000. Rate of depreciation, 10%. Amount to be written off over 10 years, $45,000 ($50,000, less scrap value, $5,000).

The following shows how this method is taken care of on the general ledger (assuming depreciation credit is credited directly against plant account):

Plant Account

1920			
Jan. 1	Cash	$50,000	
Dec. 31	Depreciation		$ 4,500
	Balance		45,500
		$50,000	$50,000
1921			
Jan. 1	Cash	$45,500	
Dec. 31	Depreciation		$ 4,500
	Balance		41,000
		$45,500	$45,500
1922			
Jan 1	Balance	$41,000	

The method illustrated above is not scientific nor convenient, as separate calculations must be made with each addition to the plant. Moreover it has this unfavorable feature: Each year's charge for depreciation against revenue is equal.

At first sight, this would seem correct, but in reality it is unfair, because repairs and small renewals are very light during the earlier years and, as a result, there are small charges against revenue at a time when it is receiving the benefit of the best period of the asset's life. On the other hand, in the later years, when the plant is much worn down and repairs are heavy, the revenue account bears a greater burden, although it has only the benefit of machinery that is well worn.

2. Reducing Installment Method.—Under this method, a fixed percentage of the diminishing value of the asset is charged to revenue annually, so as to reduce the asset to scrap value at the end of its life. In addition, repairs and small renewals are also charged to revenue. By this method, the direct

charge for depreciation becomes gradually reduced from year to year, the depreciation being heavy during the earlier years, when repairs and partial renewals are small, and lighter as repairs and partial renewals increase. The annual charge of depreciation is thus more even as compared with the fixed Installment Method, where the annual charge for depreciation is constant, while repairs tend to increase.

Furthermore, it is more simple to operate than Method No. 1, because it is not necessary to make separate calculations on additions to the asset during subsequent years, as the percentage of depreciation for the year is always figured upon the balance shown by the asset account.

Illustration of the Diminishing Installment Method.—A fleet of motor trucks cost, say, $25,000 on January 1, 1922. Value at end of estimated life of five years is figured at $4,000. Rate of depreciation, 20 per cent.

Auto Delivery Equipment

1922			
Jan. 1	Trucks	$25,000	
Dec. 31	Depreciation (20% on $25,000)		$ 5,000
	Balance		20,000
		$25,000	$25,000
1923			
Jan. 1	Balance	$20,000	
Dec. 31	Depreciation (20% on $20,000)		$ 4,000
	Balance		16,000
		$20,000	$20,000
1924			
Jan. 1	Balance	16,000	
Jan. 1	Addition	2,000	
Dec. 31	Depreciation (20% on $18,000)		$ 3,600
	Balance		14,400
		$18,000	$18,000
1925			
Jan. 1	Balance	$14,400	

Under this method, more time is required to write off the asset to its break-up value than under Method No. 1.

3. Depreciation, Repairs and Renewal System—In this method, an estimate is made in advance to cover the following: (1) cost of the asset: (2) cost of estimated renewals and repairs. The total of these two items, less the scrap value of the asset, is divided by the estimated life, and the result is the annual charge to depreciation. The main object of this system is to equalize the annual charge against revenue to cover depreciation, repairs and renewals.

ILLUSTRATION—Depreciation, Repairs and Renewals Fund—A machine costs say, $4,000 on January 1, 1920. Estimated life, 5 years. Value as scrap at end of 5 years estimated at $200. Amount to be written off over 5 years $4,000—$200) $3,800. Total estimated repairs and minor renewals of parts $500 for the 5 years. Total average yearly charge to revenue is 20% of $3,800 plus $500) or $860; computed on the cost, the rate is 21.5% ($860 divided by $4,000 = 21.5%).

Machinery and Equipment

1920 Jan. 1	Cash	$4,000
1922 Jan. 1	Addition	4,000

Depreciation, Repairs and Renewal Fund Account

1920			
Dec. 31	Repairs and renewals	$ 125	
	Balance	735	
			860
1921			
Dec. 31	Repairs and Renewals	165	
	Balance	1,430	
			1,595
1922			
	Repairs and renewals	225	
	Balance	2,925	
			$3,150
1920			
Dec. 31	Profit & Loss Account (21.5% on $4,000)	$ 860	
			860
1921			
Jan. 1	Balance forward	735	
Dec. 31	Profit & Loss Account (21.5% on $4,000)	860	
			1,595
1922			
Jan. 1	Balance forward	1,430	
Dec. 31	Profit & Loss acct. (21.5% on $8,000)	1,720	
			$3,150
1923			
Jan. 1	Balance forward	$2,925	

The above method, however, is not to be recommended without discrimination, for, being based more on estimates than either of the two preceding methods, it should only be put into practice where the experience of the past furnishes a reliable barometer of the future.

4. The Sinking Fund or Depreciation Fund System—In this method, an equal amount is charged to revenue each year, and credited to a Sinking Fund Account, or a Depreciation Fund Account. This amount is usually invested in outside investments and allowed to accumulate at compound interest. This method is a very excellent one.

Depreciation Fund Method

A plant cost, say $110,000 January 1, 1920. Estimated life, 10 years. Estimated value of plant as scrap at end of 10 years is $10,000. Amount to be accumulated by the Sinking Fund or Depreciation Fund is $100,000 (110,000—$10,000). The annual charge to revenue and credit to the fund in this case amounts to $7,950.46. This figure is derived from the following calculations:

Assuming that money will, on the average, earn 5% interest, an interest table will show that $1, compounded at 5%, will, at the end of 10 years, amount to $12.577892. Now, if $1 amounts to $12.577892, the yearly figure required to amount to $1 will be $1 divided by 12.577892, or $.0795046. Therefore, if an annual installment of $.0795046 produces $1 in the period stated, the annual amount required to raise $100,000 in 10 years will be $.0795046 × 100,000 = $7,950.46 per year.

However, it is not the general practice to make such calculations when a Sinking Fund is being created, as practically all calculations can be obviated by using one of the interest tables now on the market.

These tables show the equal annual sums to be set apart and accumulated at compound interest to provide $1 at the end of any number of years, generally up to 100 years and at various rates of per cent. The annual installment is quoted as a decimal (six to eight places of $1). This figure is simply multiplied by the amount to which the Sinking Fund must accumulate and the annual charge of revenue thus ascertained.

5. Re-valuation Method.—In this method, a valuation is obtained, and the difference between the valuation and the previous figure is charged to the profit and loss account.

Re-valuation Method

1920		
Jan. 1	Cash	$5,000
Jan. 25	Repairs	150
March 15	Additions	1,500
Oct. 10	Repairs	225
		$6,875
1921		
Jan. 1	Balance forward	$6,000
1920		
Dec. 31	Balance (Actual value on December 31)	$6,000
	Profit and Loss	875
		$6,875

Anti-Trust Law to Be Amended

So far as the public mind traveled from the trust-busting days of the early nineteen hundreds, that leading industrialists have organized and announced a move to get the Sherman anti-trust and the Federal Trade Commission laws amended. The aim is to make it possible for trade associations to cooperate more freely on the subjects of prices and output. This would effect economies without actual corporate combinations. At present, such associations are legally limited to the publication, or exchange between members of information concerning past events; prices received and quantities produced. To go beyond this is illegal. But since the anti-trust laws were enacted there have been marked changes in the conditions under which business must be done, one of which is the rise and threat of intensive competition by big foreign units not bound by Sherman law limitations.

The attitude of the Administration is one of neutrality. The aim of the Federal authorities at present is not to seek amendment of the present laws on the subject of trade combinations, but rather to interpret and administer them with discretion and common sense, having due regard for changed economic conditions.

Although reasonably satisfactory to business for the present, the position is insecure because it rests on the attitude of a changing personnel. It is particularly important that American industries, such as steel and oil, engaged in active competition with foreign combines, or dependent upon them for raw material, such as rubber and fertilizers, should have their hands freed to take whatever measures are necessary for their own protection.

It is equally essential that the consuming public be protected from monopoly exploitation. To permit economic and desirable cooperation and association and yet to prevent its abuse, is a regulative function of great difficulty and importance. Business men should watch this development closely and render such assistance as may be possible. It is highly desirable, while Government and public are fairly friendly to "big" business, to get reasonable regulation intrenched in the form of law.

Acid Proof Cements

Pulverized Silicon is added to ordinary acid proof cements containing water glass to increase the thermal conductivity of the cement. I. G. Farbenindustrie Akt. Ges. (British Patent 258, 199).

INTIMATE NEWS OF MEN AND PLANTS

Soviet Geological Official Visiting U. S. Works

Professor D. M. Mushketov, director of the Soviet Geological Survey, who has arrived in this country to study the work of the American Geological Survey and other geological organizations, in a statement issued recently at the office of the Amtorg Trading Corporation, declared that recent discoveries of immense potash beds in the Soviet Union have increased the potash resources of the world by two thirds. Professor Mushketov's organization conducted the expedition which surveyed the newly revealed beds in the Solikamsk and Berezniaki regions of the Province of Perm.

"These vast fields have great economic significance, not only for the Soviet Union, but for the whole world," said Professor Mushketov.

"Geological service in the Soviet Union has more points in common with that of the United States than with any other country. Our whole service is now in process of reorganization, so that a first-hand study of the work of your Geological Survey and of American boring methods is indispensable for us. I hope also to establish closer relations with American geological institutions. We have many problems in common, including points of contact in reference to geological study in the Far East and the Pacific.

"In the Soviet Union geological work has developed rapidly in recent years. Last year our survey sent out 467 expeditions as against 60 in 1913. The aggregate borings were 9.6 miles as against 3.7 miles in 1913. Appropriations of the Soviet Government for geological work in 1928 amount to over $4,000,000 as compared with $100,000 appropriated by the Russian Government in 1913."

New Cement Plant Building

Construction was begun in September, south of Laramie, Wyoming, of the large new plant of the Monolith Midwest Portland Cement Company. The plant will have a capacity of 2,000 barrels a day at the start with provisions for an ultimate production of 6,000 barrels a day. It will cost, when completed, between one and one half and two million dollars. H. E. Christian of the MacDonald Engineering Company, Chicago, will have charge of the construction of the plant.

Oregon Lime Plant Ready

Constant progress is being made by the Black Marble and Lime company in its activities near Enterprise, Oregon, and with construction proceeding at a rapid rate it is expected that the first two kilns will be ready to fire by the first of November. The reinforced concrete construction upon which the kilns will be built has been completed and as soon as the concrete has set sufficiently work will begin on the kilns.

The engineers have just finished the survey of the right of way for the tramway and that the company may have a supply of rock ready when the kilns are complete, and in sufficient quantity to care for some winter trade and thus begin to establish itself in the open markets, quarrying and hauling, with teams and wagons has been carried on. This, of course, will not be required when the tram is completed.

Banner To Enlarge Plant

The Banner Rock Products Company of Alexandria, Indiana, has recently completed the necessary financing to construct a $400,000 plant number 2 adjacent to their present plant. The Frigidaire Company of Dayton, Ohio, has contracted to take the entire output of the plant, when completed.

Fire Destroys Massey Plant

A huge pile of steel shavings, saturated with oil, was turned into a mountain of fire when a conflagration destroyed the plant of the Massey Concrete Products corporation in Minneapolis recently. Damage to the building and machinery which it housed was estimated at $200,000 by Norman E. Cloud, local manager of the firm.

The fire, of undetermined origin, was discovered at 3 a. m. At that time flames had spread through the building, a one-story frame structure. Shortly afterward the pile of shavings, rising several stories high, caught fire.

The main building of the Massey Concrete Products corporation, about 800 feet long and 75 feet wide, was erected in 1917. Machinery for the making of concrete blocks was installed recently. Outbuildings and piles of concrete blocks cover about eight acres. Fifty employees were thrown out of work temporarily by the fire.

New California Gravel Plant

The acquisition by the California Materials, Inc., of 100 acres of land in the San Gabriel, California district and plans for the construction of one of the largest rock and gravel plants in Southern California was announced recently coincident with the offering of $350,000 California Materials, Inc., first mortgage 7 per cent sinking fund bonds by a syndicate of investment houses.

California Materials, Inc., was organized recently to acquire all the assets and business of the former Sycamore Canyon Gravel Company. The principal properties will consist of the recently acquired acreage on the San Gabriel cone on which the company's new plant of 2,500 tons daily capacity will be immediately erected. Additional properties consist of two and one-half acres of land, improved with modern fireproof warehouse and bunkers, and approximately 13 acres of decomposed granite pits.

Net earnings of the predecessor company have averaged approximately $40,000 per year for the five-year period ended December 31, 1926. Current earnings based upon operations for the first six months of 1927 were at the rate of over $60,000 per annum.

Enlarge Lime Plant

According to announcement made by George T. Weigart, president of the Batesville White Lime Company, located six miles west of Batesville, Missouri, plans have been completed for the immediate construction of three additional kilns at an estimated cost of $150,000. This will bring the total capacity up to 1,500 barrels per day, being the largest lime burning operation in the Southwest.

The present plant was completed in June, 1925, and the phenomenal increase in the chemical lime requirements of the pulp and paper industry in Arkansas and Louisiana are responsible for the rapid growth of the Batesville Company. It is expected the new units will be in operation by January 1, 1928.

Sells Magic Lime

The Atlantic Lime Corporation has entered the field as sales agents for Magic Lime, a product of the New Jersey Lime Products Corporation. Hugh Roden is president of the Atlantic Lime Corporation and the headquarters are in New York City.

Annual Asphalt Conference to be Held at Atlanta

The Sixth Annual Asphalt Paving Conference will be held at the Atlanta-Biltmore Hotel, Atlanta, Georgia, under the auspices of The Asphalt Association and The Association of Asphalt Paving Technologists, during the week of November 28th, and will bring together a distinguished personnel of engineers, officials, asphalt research specialists, contractors and manufacturers in a very practical and analytical meeting, according to advance information given out by The Asphalt Association, New York, of which J. S. Helm is president.

Thomas H. MacDonald, chief of United States Bureau of Public Roads, is listed as one of the outstanding speakers. He is expected to stress the great national problem of conserving the vast mileage of highways already constructed through some method of resurfacing which will utilize the full foundation value of the old pavements, as into the construction of these pavements has gone the immense investment of some $8,000,000,000. Col. Woolsey Finnell, Director of Highways of Alabama, is chairman of the Engineering Committee, and his associates on the comittee constitute an impressive list of the foremost state, city, county and research engineers throughout the United States, including the following: J. T. Bullen, Parish engineer, Caddo Parish, Shreveport, La.; Harwood Beebe, consulting engineer, Spartanburg, S. C.; R. Keith Compton, director of public works, Richmond, Va.; J. H. Dingle, city engineer, Charleston, S. C.; Jay Downer, chief engineer of Westchester County Park Commission, Bronxville, N. Y.; G. F. Fisk, first assistant, city engineer, Buffalo, N. Y.; W. B. Fowler, city engineer, Memphis, Tenn.; Capt. James M. Garrett, city engineer, Montgomery, Ala.; W. S. Hawkins, Harrison County engineer, Gulfport, Miss.; G. H. Anderson, chief engineer, Rhode Island State Board of Public Works, Providence, R. I.; J. B. Hittell, chief engineer, Board of Local Improvements, Chicago, Ill.; W. W. Horner, chief engineer, Sewers and Streets, St. Louis, Mo.; Col. J. M. Johnson, consulting engineer, Marion, S. C.; J. N. Mackall, chairman and chief engineer of State Road Commission, Baltimore, Md.; W. R. Neel, state highway engineer, East Point, Ga.; W. C. Olsen, consulting engineer, Raleigh, N. C.; P. C. Painter, city manager, Greensboro, N. C.; W. O'D. Rockwell, city engineer, Savannah, Ga.; H. L. Shaner, commissioner of public works, Winston-Salem, N. C.; H. B. Smith, Burlington county engineer, Mt. Holly, N. J.; R. M. Smith, deputy minister of highways, Toronto, Ont., Canada; Bryson Vallas, city engineer, New Orleans, La.

Francis P. Smith, consulting engineer of New York City, is chairman of the Research Committee. Associated with him are T. R. Agg, professor of highway engineering, Iowa State College, Ames, Iowa; A. R. Eberts, engineer of tests, Allegheny County, Pittsburgh, Pa.; W. J. Emmons, research specialist, United States Bureau of Public Roads, Washington, D. C.; Roy M. Green, manager of Western Laboratories, Inc., Lincoln, Neb.; H. L. Howe, Jr., director, Municipal Testing Laboratory, Rochester, N. Y.; Prevost Hubbard, chemical engineer, The Asphalt Association, New York; L. M. Law, chief chemist, New Orleans Refining Co., New Orleans, La.; C. A. Mullen, consulting engineer, Montreal, Canada; Hugh W. Skidmore, president, Chicago Paving Laboratory, Chicago, Ill.; C. H. Underwood, city chemist, Indianapolis, Ind.

Dinner Reward for Safety

At the expense of the United States Gypsum Company about 175 men of the Oakfield, New York, plant dined on clams and chicken recently at a special celebration given by the company as a reward for the accomplishment of going through the entire year without a lost time accident.

New Silica Sand Plant

Installation of the new plant of the Silica Sand Company near Oceanside, California, is progressing rapidly, according to A. R. Benell, president of the company. The Santa Fe has completed a siding for the loading of cars and the silica company has started the cement foundations for many of the portions of the plant, including bins, drying sheds, furnace room and other buildings. Alongside the track will be located the bins for the storage and loading of the various grades of the silica products and contracts now made by the company already call for the loading of two cars a day.

New Lehigh Plant Operating

The Lehigh Portland Cement Company's new plant at Metaline Falls, Washington, started operations October 1, according to W. G. Perrow, district manager. About 50 former employees were reemployed at the plant.

New U. S. Gypsum Product

Structolite tile, load bearing, just have been announced by the United States Gypsum Company. These tile have hollow cores and are designed for the erection of exterior walls and bearing partitions in residences, garages and other light occupancy buildings. They are designed to withstand loads of 1,000 pounds per square inch gross area, and are rugged enough to be shipped and handled without excessive chipping.

Structolite tile are manufactured from Structolite cement, which is extensively used in poured masonry construction, and can be obtained in standard 8″ x 8″ x 16″ and 8″ x 6″ x 16″ patterns. They also can be obtained in 8″ x 12″ x 16″ and 6″ x 12″ x 16″ sizes. None of the patterns weigh more than 35 pounds. According to the manufacturer's announcement, the tile are kiln dried, and are uniform in size, strength and weight.

Because they are manufactured from gypsum, Structolite tile are incombustible. The manufacturer claims that they effectively retard the passage of sound as well as heat; and that construction economies are obtained by the use of the tile as a result of the ease with which the units are erected.

Further advantages claimed in the announcement are these: The tile can be nailed, sawed and fitted with the ease of soft wood; they provide a true surface for exterior stucco; brick veneer easily is laid up over the tile; and with the tile reinforced tile lintels are easily made on the job.

Cement Plant Changes Hands

According to a recent report Wood, Gundy and Company have purchased the cement plant of the Canada Cement Company. Shareholders of the old company will receive $250 a share for their common stock holdings and $215 a share for preferred stock holdings.

Hill Clutch Open Office in New York City

The Hill Clutch Machine and Foundry Company have opened a New York office at Room 528, 30 Church street, in charge of Mr. Charles C. Phelps, sales engineer.

Marquette to Enlarge

The Marquette Cement Manufacturing Company has completed plans for expanding its plant at La Salle, Illinois, and work is already under way which will increase the capacity of the plant by 1,000,000 barrels a year.

Production of Stone Increased in 1926

Production of stone in the United States in 1926, exclusive of stone manufactured into lime cement, and abrasive materials or crushed into sand, amounted to more than 124,476,360 short tons, valued at $188,308,590, according to compilation of reports from producers made by the United States Bureau of Mines, Department of Commerce. The figures show an increase of 7 per cent over the 1925 production figure of 115,851,370 short tons.

Stone sold as building stone, flagstone, crushed stone, flux, refractory stone, riprap and miscellaneous uses increased in quantity and stone sold as monumental stone, paving blocks, rubble, curbing and for manufacturing industries decreased.

Building Stone

The building stone sold amounted to 33,342,420 cubic feet—9 per cent more than in 1925. This includes stone for architectural work and relatively low-priced stone for rough construction, such as foundation, bridges, and unshaped face stone for buildings and retaining walls.

More than one-half of the building stone sold was limestone, 18,412,950 cubic feet, valued at $20,391,597, this quantity being 15 per cent more than in 1925. The largest quarry center for building limestone, the Bedford-Bloomington district in Indiana, reported total sales from the quarries of 14,171,490 cubic feet in 1926, valued at $18,063,148, an increase of 20 per cent in quantity over 1925. Of this total 5,747,510 cubic feet, valued at $3,510,665, was sold as rough stone; 4,982,780 cubic feet, $4,654,126, sawed stone; 513,460 cubic feet, $1,047,692, semi-finished stone and 2,927,740 cubic feet, $8,850,665, cut stone. The mills of this district not operated in connection with the quarries reported sales of 402,250 cubic feet of sawed and semi-finished stone, valued at $414,416 and 1,109,000 cubic feet of cut stone valued at $3,658,855. High-grade building limestone quarried at Russellville, Ala., amounted to 135,600 cubic feet; at Bowling Green, Ky., to 134,460 cubic feet; at Mankato and Kasota, Minn., to 245,330 cubic feet.

Total sales of granite for building stone (8,181,910 cubic feet, valued at $6,883,513), represented nearly one-fourth of the building stone produced in 1926, an an increase of 9 per cent in quantity over 1925. The granite sold for architectural work, including rough and dressed stone, was 2,076,560 cubic feet, valued at $6,031,248, a small decrease in both quantity and value. Granite sold for rough construction showed increased sales. The principal states producing granite for architectural building stone were Maine (561,470 cubic feet), Massachusetts (512,480 cubic feet), California (189,240 cubic feet), North Carolina (182,890 cubic feet), New Hampshire (166,810 cubic feet), Georgia (115,590 cubic feet), and Minnesota (87,450 cubic feet). Pennsylvania, Massachusetts, and Maryland produced a considerable quantity of granite for rough construction work.

Total sales of sandstone for building (3,346,550 cubic feet, valued at $3,154,207), a small decrease in quantity from 1925. Sandstone for architectural work, including rough, sawed, and finished stone, amounted to 2,536,770 cubic feet, valued at $3,057,015, an increased in quantity of 5 per cent. Ohio produced 1,747,030 cubic feet. Kentucky, New York, Pennsylvania, Washington and other states also reported considerable amounts.

Marble sold for building stone in 1926 amounted to 2,867,940 cubic feet, valued at $9,419,939, practically the same quantity as in 1925. The principal states producing building marble are Tennessee (909,580 cubic feet), Missouri (655,210 cubic feet), Vermont (797,990 cubic feet), and Georgia (130,180 cubic feet). Alabama, Alaska, Arkansas, California, Colorado, Maryland, Massachusetts, New Jersey, New York, North Carolina, Pennsylvania, and Utah also furnish marble for building purposes. The product from Georgia and Missouri is chiefly for exterior building and that from Tennessee and Vermont for interior work. Serpentine (58,430 cubic feet, valued at $423,358) quarried in Maryland, Massachusetts, New Jersey, Pennsylvania, and Vermont, is included in the marble figures. There was also sold 11,800 short tons of serpentine, valued at $51,358, chiefly for stucco and terrazzo work. The total sales of marble reported from Carthage, Mo., for 1926, were 459,580 cubic feet, valued at $1,056,452, a decrease in quantity of 11 per cent from 1925. This includes a small quantity of monumental stone. Marble quarried at Phenix, Mo., chiefly for interior building work, amounted to 214,600 cubic feet in 1926. Basalt and various miscellaneous varieties of stone used chiefly for rough construction showed decreased output for 1926.

Stone Sold or Used by Producers in the United States, 1925 and 1926, by Uses

Use	1925 Quantity	1925 Value	1926 Quantity	1926 Value
Building stone, cu. ft.	30,695,310	$ 35,444,809	33,342,420	$ 39,922,851
Approximate equivalent in short tons	2,392,420	.....	2,589,190	.....
Monumental stone, cu. ft.	4,371,380	14,404,339	4,335,770	14,580,929
Approximate equivalent in short tons	363,060	.....	359,950	.....
Paving blocks, number	40,143,220	3,680,687	39,563,180	3,399,602
Approximate equivalent in short tons	380,710	.....	366,370	.....
Curbing, cubic feet	5,075,620	4,313,446	4,409,930	4,303,280
Approximate equivalent in short tons	393,460	.....	346,020	.....
Flagging, cubic feet	762,280	562,344	902,424	657,435
Approximate equivalent in short tons	55,790	.....	66,330	.....
Rubble, short tons	1,197,170	2,060,868	539,670	917,433
Riprap, short tons	3,079,270	2,794,379	4,060,280	4,652,717
Crushed stone, short tons	75,672,930	80,508,429	82,515,560	87,872,014
Furnace flux (limestone and marble), short tons	22,860,890	17,344,190	23,859,390	18,049,012
Refractory stone (ganister, mica schist, and dolomite), short tons	1,261,130	1,548,190	1,531,070	1,925,832
Manufacturing industries (limestone and marble), short tons	5,171,520	4,941,669	4,953,800	4,376,026
*Other uses, short tons	3,023,020	6,613,442	3,288,730	7,651,459
Total (quantities approximate in short tons)	115,851,370	$174,216,792	124,476,360	$188,308,590

*Chiefly agricultural limestone.

Monumental and Memorial Stone

Stone sold for monumental and memorial work in 1926 amounted to 4,335,770 cubic feet, valued at $14,580,929, a decrease of less than 1 per cent in quantity.

Granite (including rough and dressed stone) reported as sold for this purpose was 3,240,550 cubic feet, valued at $10,533,072, an increase of 1 per cent in quantity. The principal states producing granite for monumental work in 1926 were Vermont (1,282,830 cubic feet, of which the Barre district produced 1,062,160 cubic feet), Massachusetts (340,950 cubic feet, of which the Quincy district produced 278,350 cubic feet), Minnesota (245,200 cubic feet), Rhode Island (241,490 cubic feet), Maine

(159,220 cubic feet), New Hampshire (130,400 cubic feet), Georgia (135,670 cubic feet), Wisconsin (131,990 cubic feet), and California (73,770 cubic feet).

Sales of marble for monumental work (including rough and finished stone) in 1926 were reported as 1,095,220 cubic feet, valued at $4,047,857, a decrease of 7 per cent in quantity. Vermont produced 624,840 cubic feet, Georgia 389,680 cubic feet, and Alabama, Arkansas, Massachusetts, Missouri, New York, North Carolina, and Tennessee much smaller amounts.

Road Work and Concrete

Street and road material in general showed increased sales in 1926, although sales of paving blocks (39,563,180 blocks, valued at $3,399,602) decreased 1 per cent in quantity, and stone sold for curbing (4,409,930 cubic feet, valued at $4,303,280) decreased 13 per cent. Stone sold for flagstones (902,424 cubic feet, valued at $657,435) increased 18 per cent in quantity. Total crushed stone amounted to 82,515,160 short tons, valued at $87,872,014 in 1926, an increase of 9 per cent in quantity. Crushed stone for concrete and road work (66,892,530 tons, valued at $75,049,930) increased 6 per cent in quantity, and crushed stone reported as used for railroad ballast (15,623,030 tons, valued at $12,822,084) increased 22 per cent.

Fluxing Stone

Stone sold for fluxing to blast furnaces, open hearth steel works, smelters, and other metallurgical plants, amounted to 23,859,390 short tons, valued at $18,049,012, an increase of 4 per cent in quantity.

Refractory Stone

Stone reported for refractory use, which includes dolomite, quartzite, and mica schist, amounted to 1,531,070 short tons, valued at $1,925,832, in 1926, an increase in quantity of 21 per cent. Raw dolomite reported as sold for the manufacture of refractories in 1926 amounted to 511,300 short tons, valued at $458,802. Besides this quantity, operators who both quarry and dead-burn or sinter dolomite reported 386,715 tons of sintered material, valued at $3,593,731. The quantity of raw dolomite reported was 23 per cent more than in 1925, and the sintered material decreased slightly. Quartzite (ganister) used in the manufacture of refractory brick, for furnace lining, and for the manufacture of ferrosilicon, amounted to 984,470 short tons, valued at $1,321,824. This was an increase of 22 per cent in quantity. Sales of mica schist for furnace and kiln lining, which is quarried in Montgomery County, Pa., near Edge Hill, amounted to 35,300 tons, valued at $145,206, a decrease in quantity of 7 per cent. Sales in 1926 of pulverized limestone for agricultural use amounted to 1,850,620 tons, valued at $3,064,235, a decerase of 5 per cent in quantity over the sales for 1925. The accompanying table shows the sales of stone in 1926 by uses and the sales for 1925 for comparison.

Cement Plant Safety Record

Up to September 25th the Duluth plant of the Universal Portland Cement Company had operated 592 days without a lost-time accident. This record exceeds by forty-nine days the high mark by which the plant won the safety monolith in 1926. A special effort is being made at the plant to finish the year without a lost-time accident.

The effectiveness of the cement plant safety efforts is largely enhanced, according to Mr. Huth, the superintendent, by the keen and intelligent interest shown in the movement by the employees themselves. No official could be more active or vigilant in preventing accidents than the rank and file of the employees. Employees who show a tendency toward carelessness or bravado in handling machinery or approaching perilous tasks find themselves targets for earnest expostualtion and advice. If persistent in disregarding co-operation for safety the offenders soon fell under universal condemnation and either mend their ways or leave the plant.

The results of the safety campaign are felt not only in the saving of compensation costs, but in lowering the labor turnover and in the increased efficiency of the working force because of the awakened interest in their tasks.

Orange County Rock Co. Changes Plan of Operation

The Orange County Rock Company has disposed of its rock plant and business in Orange County, and will now operate solely in the Imperial Valley at Frink (Niland Postoffice), California.

A new corporation has been formed under the name of Imperial Rock Corporation and will operate in the Imperial Valley under that name. The offices of the Imperial Rock Corporation are at Frink, (Niland Postoffice) and El Centro, California. Its officers are: President, A. G. Wright, secretary and treasurer, W. F. Blaikie.

Operations in the Imperial Valley began on Monday, September 19, 1927, and the offices of both companies were removed from Orange to the Imperial Valley on that date.

S. S. Steinberg Resigns

Professor S. S. Steinberg, head of the department of civil engineering at the University of Maryland, has resigned as assistant director of the highway research board, National Research Council, in order to return to his duties at the University and to practice as consulting engineer on road and street construction. His offices will be at College Park, Maryland.

New Incorporations

Foundry Sand & Products Co., New Albany, Ind. $3,000. Michael E. Maloney, William C. Broadfuehrer, Claude O. Davis.

National Lime Cement & By-Products Corp., State Bank Bldg., Pittsburgh, Pa. Francis L. Hoff, Pres. 10,000 shares, n.p.v.

Magnolia State Gravel Co., Myles, Miss. $10,000.

South Florida Rock Corp., Miami, Fla. $10,000. E. G. Moore, S. K. Hicks, 60 W. Flagler St.; E. E. Saar.

Alabama-Quenelda Graphite Co., Comer Bldg., Birmingham, Ala. $5,000,000.

Monroe Sand & Gravel Corp., Rochester, N. Y. $50,000 pfd.; 1,000 shares, n.p.v.

The Midwest Pipe Construction Company has been incorporated at North Manchester Maryland for $35,000 to engage in the business of buying, selling and dealing in cement.

The Standard Cement Construction Company of Kentucky has been incorporated at Indianapolis to engage in the business of manufacturing cement and lime products.

The Cuban Rock Asphalt Company has been incorporated in New Orleans with an original capital stock of $1,000,000.

The Moreau Gravel Company has been incorporated at Jefferson City, Missouri.

Canada Kiesselguhr Co., Ltd., Tortonto, Ont., Can. $50,000. E. H. Scott, J. L. Scott. To quarry kiesselguhr, mica, marble, granite, feldspar, lime, gypsum, talc, sand and gravel.

The B. G. Hoadley Quarries have been incorporated for $200,000 at Bloomington, Indiana, to engage in the stone business.

J. R. Berthelet Passes

Joseph R. Berthelet, 83 year old president of the Milwaukee Cement Company, died October 1 at his residence in Milwaukee.

NEWS OF EQUIPMENT MANUFACTURERS

Power Units and Engines Described by Waukesha

A new bulletin from the Waukesha Motor Company describes their gasoline engines and power units for industrial purposes with rated horsepower from 20 to 125. The motor used is of the Waukesha "Ricardo Head" type, designed and built for heavy duty service. The same motors are used in concrete mixers, locomotives, hoists, pumps, excavators and shovels.

The housing is made of heavy gauge steel reinforced by heavily ribbed cast bases at front and rear. An easily removable sliding door on each side provides ready inspection of unit. Provision is made at the bottom to bolt unit to wood or steel sills or concrete foundation.

The radiator is of the "Perfex", honeycomb type, of such size as to secure proper cooling. It is protected by radiator guards cast integral with cast radiator housing which relieves core of twisting strains. Air is drawn through by large cooling fan. No gasoline tank is furnished, the fuel being drawn direct from the gasoline drum through a flexible tubing to the vacuum tank.

The clutch is of the heavy duty dry disc type. Units are furnished with clutch except for special work. The governor is Waukesha, self-lubricated, completely enclosed and close regulating. Ignition is by magneto, using standard make of magneto with impulse starter. A dynamic thermostat automatically controls hot air supply to carburetor and insures smooth operation at both high and low speeds and variable load.

G. E. Appointments

W. M. Stearns has been transferred from the central station department of the General Electric Company to the general commercial department, and has been appointed manager of special contracts. He will also act as an assistant to Vice President J. G. Barry.

A. D. Cameron has been appointed manager of the street lighting and supply division of the central station department, and there has been set up in the same department a holding company division with W. P. White as manager.

F. H. Winkley has been appointed manager of sales of the street lighting section of the street lighting and supply division, succeeding Mr. Cameron.

Alliance Tank Expands

The Alliance Tank Company have increased their authorized capital stock from $60,000.00 to $95,000.00. The company was organized May 19th, 1926, under the laws of the State of Ohio, for the purpose of manufacturing steel tanks and miscellaneous plate work by means of the Lincoln "Stable-Arc" welding process.

The officers are: E. L. Coble, president and general manager; A. L. Haidet, vice president and treasurer; and George E. Harding, secretary.

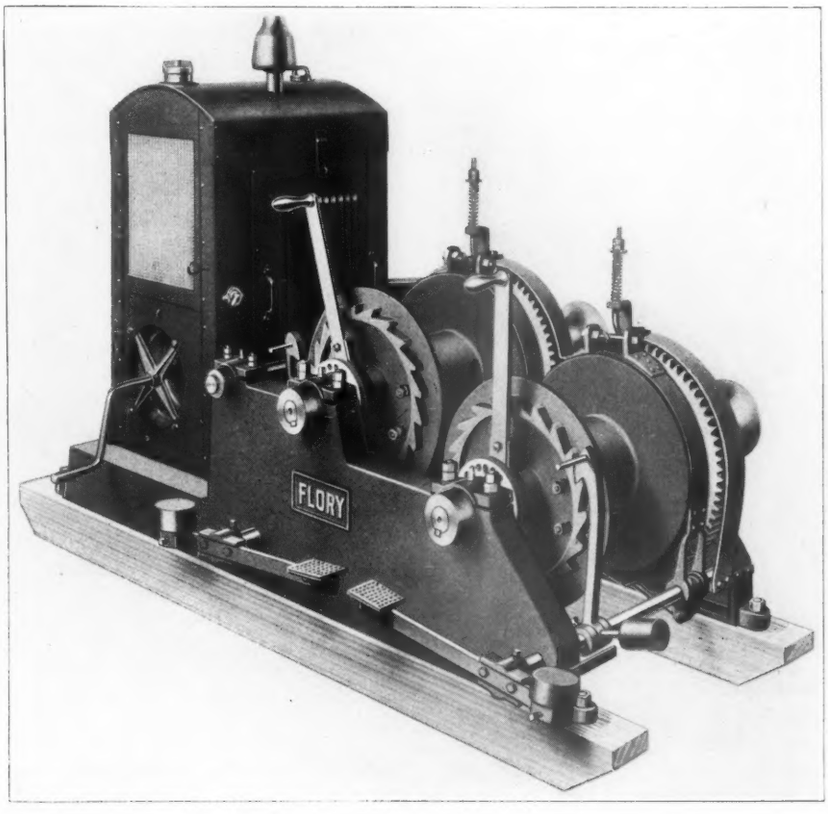
The new plant is of all steel construction, including roof and siding. The roof is of 22 gauge corrugated cooper bearing steel and the siding is of the same material but of 24 gauge. Electric welding was utilized in fastening the corrugated steel sheet to the structural members. All the interior fittings, such as brackets, bracing, line-shafts, hangers, etc., were electric welded.

The company specializes in gasoline, oil storage and pressure tanks, vats, oil pits for filling stations, paint kettles and varnish tanks, distributed under the trade name of "Thoro-weld" tanks.

New Light Duty Hoist

The illustration shows a new light duty hoist called the "Cub" manufactured by the S. Flory Manufacturing Company and recently placed upon the market. It is a light weight, compact and powerful small hoist, designed for light duty hoisting operations, having a capacity of 1,500 pounds single line pull at a drum steel of 125 feet per minute. It is made with a solid cast iron base upon which is mounted a two cylinder 8-10 h.p. gasoline power unit, radiator cooled, driving the gearing through sprockets and chain, which are enclosed in a sheet steel casing.

All gears have machine cut teeth and the friction clutch is equipped with moulded asbestos cone. The brake is two piece, band type, lined with non-burning material and band is suspended from bracket with spring, always held free when not in use. The hoist is also equipped with winch head and ratchet and pawl and the complete outfit is mounted on skids, made in single and double drum types. The weight of single drum outfit is 1,250 pounds and the weight of double drum outfit is 1,700 pounds.



New Flory Hoist

Whitcomb Gasoline Locomotive Described in Bulletin

The six, seven and eight ton gasoline locomotives of the George D. Whitcomb Company are described in Bulletin 2723 recently issued. The relative positions of the various units are the same as in standard automobile practice. The radiator is located at the front end, and back of it is the engine. The clutch is housed in the flywheel of the engine. Back of the clutch is the transmission. The engine is covered by a hood similar to a truck hood and at the rear end of the locomotive is an open type of cab with side curtains. Entrance is at the rear of the cab, but if side entrance is desired, it can be provided. A fully enclosed cab can also be provided when necessary. The transmission is located at about the center of the cab and the shift, forward and reverse levers of transmission are convenient for the operator.

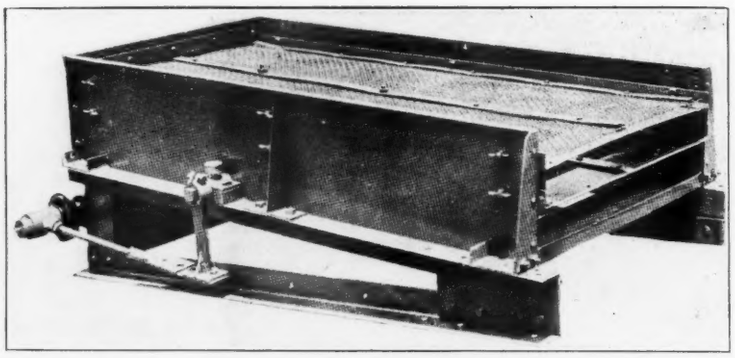
The frames are of exceptionally heavy cast section. The ends of the frames, and the back surfaces of the bumpers which bear against the frames, are machined. The bumpers are bolted by means of heavy studs to the ends of the frames, so that constant and correct alignment and rigidity is assured. The lugs which support the driving mechanism are cast as integral parts of the frame, so that these heavy cast frames and bumpers form a bed plate or foundation to which all the driving mechanism is bolted. The locomotive throughout is designed so that all stress and pull is carried by the frame and not by the transmission case.

The engines used on the 6, 7 and 8-ton locomotives are of the heavy duty industrial 4-cylinder, 4-cycle water-cooled type.

They embody all late improvements such as force feed oil circulation by means of a pump through the drilled crank shaft so that the oil is carried to all bearings under pressure, thus insuring constant and adequate lubrication. Water circulation is also by force feed, secured by pump driven by means of a gear drive from the engine crank shaft. Ignition is by means of Bosch high tension magneto with impulse coupling. Engines are fitted with electric starting and lighting outfits, and can be started by simply pushing the starting switch.

C. E. Shearer Resigns

Charles E. Shearer, for several years advertising manager for the Industrial Works, Bay City, Michigan, has resigned, effective October 20th. No announcement has yet been made as to his future connection.



New Slugger Screen Manufactured by Cottrell Engineering Company Described in September 28th Pit and Quarry

New Wire Rope Data

Along with the more modern methods of selling which seek to give the buyer information on the applications and uses of the products he buys is the revised edition of "Practical information on the use and care of wire rope", published by A. Leschen and Sons Rope Company. This little booklet, originally published in 1920 and now revised for the first time, is a veritable mine of information for the user of wire rope and with refreshing display of common sense, subordinates advertising of the manufacturers' product to the real purpose of the publication. This partly unselfish endeavor should, in time, be reflected in larger sales of "Hercules" wire rope and will certainly place its publishers in an enviable position in the field.

The booklet contains so much information on the subject indicated that it would be unjust to attempt to describe it in the space limitations of this review. Some of the matters treated, however, are kinks and kinking, lubrication, safety factors, sudden stresses, speed, reverse bends, bending stress, drums and sheaves, alignment how to find the rope capacity of a drum, binding ends of wire rope, how to splice wire rope, how to apply wire rope clips, reclipping and resocketing wire rope, how to find rope stress and deflection on cableway spans, reeving tackle blocks, stresses for guy ropes, how to find stress in haulage ropes, how to measure wire rope and many other suggestions of importance to the pit and quarry operator.

New G. E. Bulletins

Several new bulletins have been issued by the General Electric Company, including No. 788 describing type FT general purpose squirrel cage motor; No. 813 describing magnetic reversing switches; No. 821 describing duplex controllers. Many of these devices have special application in the operation of modern pits and quarries. The bulletins are all illustrated and contain complete specifications of the devices described.

F. M. Young Announces New Appointments

F. M. Young, president of the Young Radiator Company, has announced the appointment of John J. Hilt as sales manager. Mr. Hilt has been associated with Mr. Young since 1919—for three and a half years at the Racine Radiator Company, when Mr. Young was vice president and general manager of that concern, and previously for four and a half years at the Perfex Radiator plant. By virtue of his experience in this field, Mr. Hilt is well qualified for his new duties, which have to do with the manufacture and sales of heavy duty industrial type radiators for taxicabs, bus, truck, tractor and power units of various types.

In the same statement, Mr. Young announced that he has acquired the services of three other department heads who served with him at the Racine Radiator Company. D. A. Hisey, former superintendent and plant manager, who has been associated with Mr. Young the past six years, has become superintendent of the Young Company, in charge of production. Mr. Hisey has done a remarkable job in his equipment of the new Young plant with the most modern and efficient machinery for radiator manufacturing, metal working and tool building.

W. C. Klespe, formerly in charge of engineering, at the Racine Radiator Company, is now engineer in charge of machinery design, radiator and tool layout at the Young factory. Christ R. Trumm, formerly in charge of the tool department and machine manufacture, another associate of Mr. Young for years, has been placed in charge of the tool room and machine production work for the Young Company. Mr. Trumm has to do with the placing and purchasing of machinery equipment and he has set up an extensive battery of modern machines for the production of tools and dies used in the manufacture of radiators and in machine shop production work.

THE GRIZZLY HAS COME TO STAY

By F. W. Kenzler
Engineer, Stephens Adamson Manufacturing Company

Parallel steel bars or bars at right angles set within a containing frame mounted flat or on an incline have been known as gratings or grizzly screens. Their chief use is to allow the passage of materials ranging under a certain dimension and to guard against the passage of oversize material or objects. The grizzly has been successfully used in many industries under various conditions. Placed over charging hoppers for crushers and similar machinery, the grizzly excludes all excessively large material and foreign objects.

The inclined bar grizzly is also used to a certain degree for a service approximating a screening action. The aggregate is introduced onto the sloping grating with the result that the fines pass through the openings and the oversize is carried on top of the grating to be separated at the bottom of the grizzly from that material which passes the openings.

The stationary grizzly, both horizontal and inclined, however, has had certain definite limitations. It is not difficult to flood a bar grating to the extent that the material will not have an opportunity to separate. There is an ever present possibility of clogging which cannot be avoided as there is practically no agitation to relieve this condition. These and other disadvantages have encouraged the use of power driven grizzlies of many different types. With the addition of power greater capacities and more complete agitation to facilitate separation are obtained.

It is the purpose of the following brief descriptions to cite the different grizzly designs which have been used successfully for handling various bulk materials.

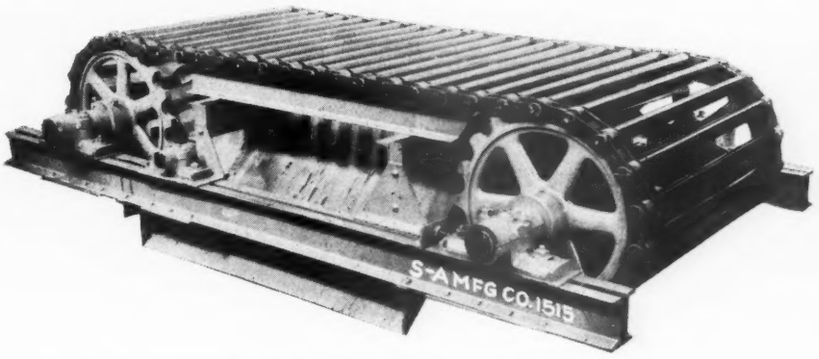
There are four principal classes under which power grizzlies may be discussed.

Chain and Cross Bar Type

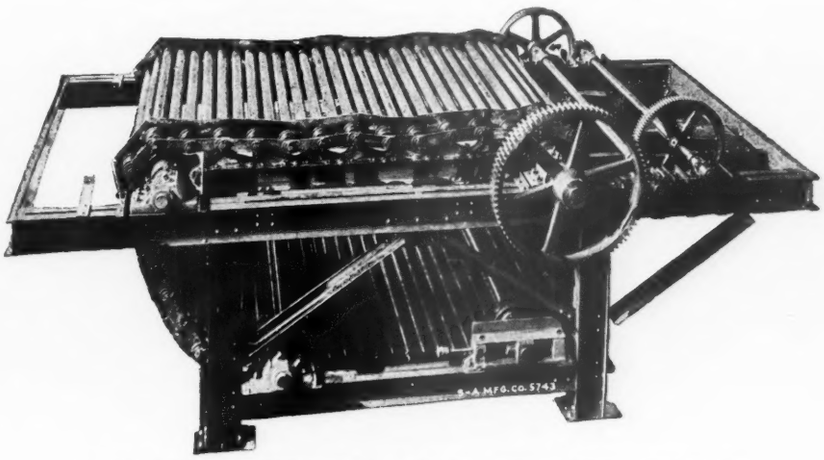
This grizzly is installed under conditions where materials containing fines and oversize are to be subjected to grizzly separation and where the oversize is necessarily to be conveyed for a certain distance beyond the loading point.

Broncho Agitating Grizzly

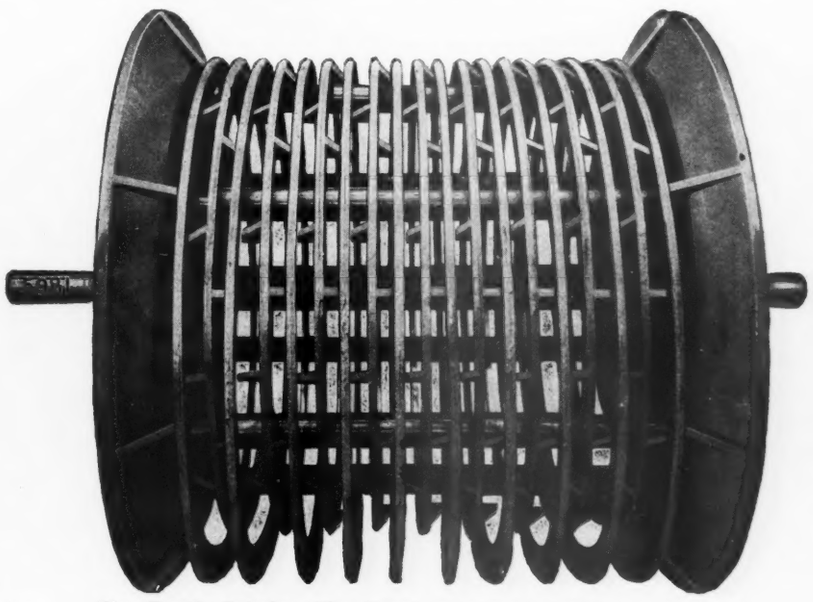
This grizzly has essentially the same advantages of the Chain and Bar Type described above, with the additional feature that the chains traverse an irregular track submitting the load to an agitating motion which increase the grizzly action.



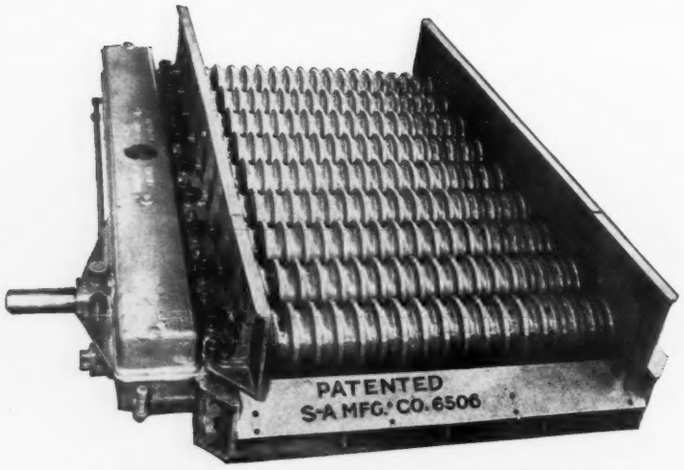
The Traveling Bar Grizzly.—The cross bar type of grizzly consists of two matched strands of chains with grizzly bars spaced to pass under size material. This type is commonly used to feed crushers which by by-passing the fines, are relieved of a large percentage of the load.



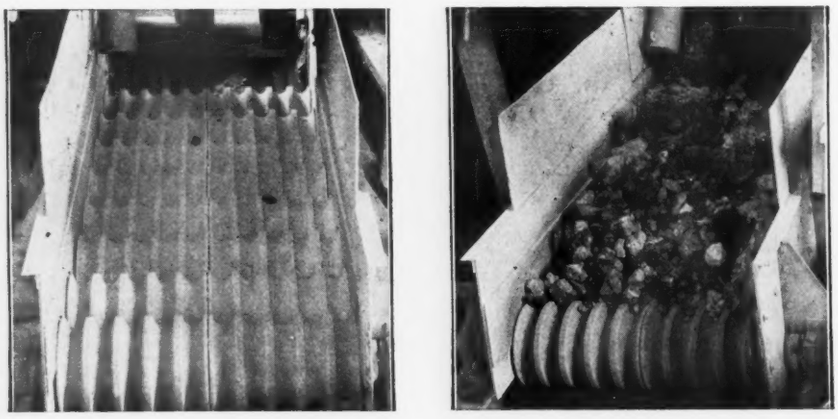
The Broncho Grizzly.—The Broncho type grizzly feeder is similar to the regular traveling bar grizzly. Fines drop through the spaces while lump material rides on the bars and are discharged over the head end. The irregular track causes a constant agitation which is a most effective aid to proper separation.



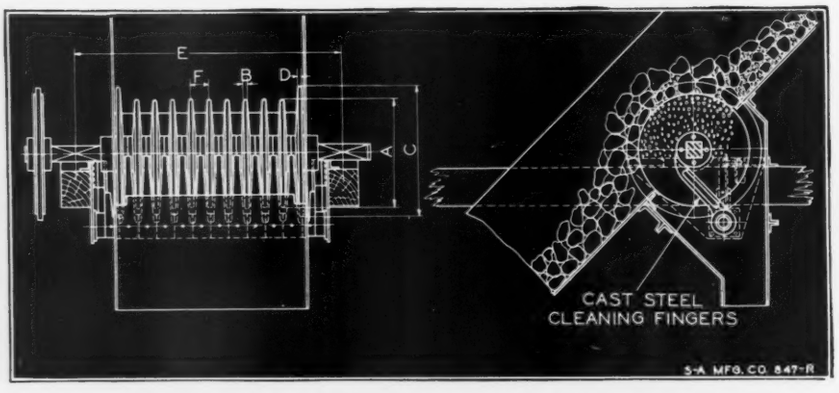
The Burch Grizzly.—The Burch ring type grizzly consists of a series of steel rings of two diameters alternately spaced. The small diameter rings are fixed in position by spacers on cross shafts. The large diameter rings ride on the spacers between rings and are held midway by lugs. This type requires little power and is positively non-clogging.



The Live Roll Grizzly.—The Live Roll non-clogging grizzly consists of a series of grooved rollers, each rotating at an increased speed. As the material rises and falls in passing over the rollers it is gently agitated and the fines settle through the openings. There is no grinding action and over-size is delivered with almost breakage.



The Live Roll Grizzly.—The illustration to the left shows how the grooves in adjacent rollers match to form round openings for passing fines. Grooves can be varied to pass different size products. The illustration to the right shows how the material rides on the ridges of the rollers, which allow for years of service before wear affects size of opening. Increasing speed of shafts thins and spreads load for better separation.



The Rotary Disc Grizzly.—The fines drop between discs while lumps ride over on the ridges. Size of material passed is controlled by varying the spaces between rings. Cleaning fingers between discs remove lumps which wedge.

Burch Ring Type

This grizzly is one which requires very little power to operate and is actually non-clogging. It can be installed where space is limited and under conditions where the loading and discharge points must be practically on the same vertical plane.

Live Roll Type

This is a non-clogging large capacity grizzly of particularly rugged design. It is suitable for successfully handling many classes of material. The aggregate is subjected to a wavy motion in passing over the series of power driven rolls and the large separating capacity results from this action.

Forged Steel Flange Design Aided By New Charts

A valuable aid to the engineer or draftsman concerned with the design of forged steel flanges for piping, tubing, pressure vessels, tanks, penstocks, etc., has recently been published by the American Spiral Pipe Works in the form of a set of charts which enable a graphical solution of the new Waters formula for the design of any plain or hub flange from 4 to 100 inches in diameter.

The determination of stress on pipe flanges under working conditions has, in recent years, been a difficult problem with engineers and designers of high pressure piping. At a meeting held in New York some years ago, at which practically every line of industry was represented, an attempt was made to formulate standards. It was found that while a few engineers had a fairly clear idea of methods of stress determination there was such wide variation of opinion that further research and data seemed advisable. With this in view the American Spiral Pipe Works undertook to make a series of tests to determine the actual strength of flanges of various shapes.

At the same time Professor E. O. Waters of Yale University became associated with the test and developed from the theoretical standpoint a formula which checked accurately with the results obtained on the testing machines. The results of this work were made public at the Mid-May meeting of the A. S. M. E. at which Professor E. O. Waters and Mr. J. Hall Taylor presented a paper reviewing past methods, setting forth the new formula developed by Professor Waters and the results of the experimental work undertaken by Mr. Taylor.

The tests which had been conducted during 1924 and 1926 included flanges of both standard and special design. These tests afforded a complete check on the correctness of the formula.

Due to the fact that a great number of variables are present in flange design the formula evolved was necessarily complicated. To overcome this difficulty the American Spiral Pipe Works prepared a series of graphical charts from which by direct reading the stresses in flanges may be determined without necessity for mathematical solution of the complicated formula. The charts are in two sections, the first covering plain ring flanges from 4 to 40 and from 40 to 100 inches in diameter. The second section covers stresses in high or low hub forged steel flanges from 4 to 100 inches.

Industrial Brownhoist Merger Completed

The stockholders' meeting of The Brown Hoisting Machinery Company was held at the company's office Monday, September 26th, and the stockholders without any dissent approved the merger and consolidation with Industrial Works of Bay City, Michigan. A similar meeting was held by the stockholders of Industrial Works, who also approved the merger and consolidation.

The union of these two companies will be effective about October 1st. The name of the new company is "Industrial Brownhoist Corporation." It is organized under the laws of Ohio, with general offices in Cleveland. Mr. Alexander C. Brown is the president of the new company. The consolidated company will continue the manufacture of material handling machinery, operating its plants at Cleveland, Ohio, Bay City, Michigan, and Elyria, Ohio. The new company, Industrial Brownhoist Corporation, will have assets totalling about fourteen million dollars.

New Drill Bulletins Issued

Bulletins Nos. 15, 5 and 78 of the Hardsocg Wonder Drill Company have recently been issued to describe the No. 1 drill sharpening and shanking machine, the No. 5 hammer drill and the Nos. 7 and 8 hammer drills, respectively.

The No. 1 drill sharpening and shanking machine has a baseplate made from steel drilled for bolting to a solid foundation, plank or timber. On one end of the base plate is bolted the housing which contains the forming dies. The upper and lower castings of the housing are held together at the rear by a hinge and at the front by a lever handle, tightened by a taper wedge. The forming dies are in two halves and are reversible, one end being arranged for sharpening and the other end for shanking and collaring These dies are made from high grade die steel, well machined and finely tempered. They receive and hold the steel being sharpened or shanked. On the other end of the base plate is bolted the boxing which clamps the air feed in position. The pneumatic hammer which delivers the power for shanking and sharpening is contained in a housing which is arranged to slide in grooves cut in the base plate. The hammer is kept in working position by the air feed which holds it against the work when in operation. Six sharpening tools are furnished with the machine, the tool with smallest face being used on first operation when a bit is being formed from the bar. The larger tools are used when sharpening larger diameter bits. The heading tool for shanking is formed with a hexagon opening to make the proper length shank. It is made with shank to be inserted into the pneumatic hammer. Swedging dies for keeping the shanks to exact size, also center pin for keeping hole in drill steel open and to good size, are furnished with the machine.

The No. 5 drill carries some decided improvements. Strength has been added to vital parts without increasing weight perceptibly, and means have been devised for perfectly cleaning holes in rock considered impossible to drill. This machine is of the spool valve type and is so constructed that it is not only an exceedingly rapid driller but it is an unusually low air consumer, making it a low operating cost machine. The solid form valve is without lining or springs, thus giving a sharp, snappy blow to the piston that cannot be obtained with other valves. Every wearing part of the drill is lubricated from an oil chamber in valve chest. An improved exhaust cap insures the open position for ordinary drilling, or the partly closed position for wet, sticky drilling. It may be closed entirely if necessary. A throttle provides for sending live air through drill and drill steel to blow out cuttings impossible to eject in any other way. An ingeniously designed inner bore piston eliminates breakage liability.

In building the No. 7 and the No. 8 drills a number of parts carried by former similar sizes have been eliminated, thereby strengthening other parts without increasing weight. The rotating mechanism has been changed from the flat type ratchet bar, rifle nut and piston end to the spiral and fluted patterns, thus giving approximately three times the wearing surface and proportionately greater wearing life of the parts affected. The shock absorber in handle has been eliminated—carrying out the plan of reducing wearing parts to the minimum. Rotation in the No. 7 and No. 8 drills is stronger than in similar size preceding models. A stronger current of live air can be sent through drill steels for the purpose of cleaning wet or damp holes.

New Hyman Michaels Bulletin

The Hyman Michaels Company has recently issued a new bulletin describing offerings in new and used equipment. The bulletin lists new and relaying steel rails, locomotives, cars, passenger and freight, railway and track equipment of all kinds, used machinery including steam and electric hoists, air compressors, boilers, crushers, generator sets, etc.

Discusses Steam Turbines

A new circular from the Westinghouse Electric and Manufacturing Company describes turbines for mechanical drive in capacities of from 5 to 750 brake horsepower.

Mechanical drive turbines are suited for driving circulating pumps, centrifugal boiler feed pumps, blowers and other rotary apparatus. They may be connected to the driven machinery either directly or through the medium of reduction gears. These turbines are of the single wheel impulse, re-entry type. This design has proved to be the most efficient and satisfactory with respect to the utilization of the heat energy contained in the steam when applied to small turbines. Steam enters the turbine through a governor controlled inlet valve and passes into a nozzle where the heat energy of the steam is converted into velocity by expansion. This steam at a high velocity impinges on the rotor blades, causing the wheel to revolve; consequently mechanical work is performed. Since it is impossible for the blades to absorb the entire amount of kinetic energy developed by the expansion of the steam, it is desirable to re-direct the steam against the blades. This is accomplished by means of a reversing chamber mounted in the turbine casing on the opposite side of the rotor disc from the nozzle.

Occasionally the steam conditions and blade speed are such that it is advantageous to use a second reversing chamber and pass the steam through the blades a third time before allowing it to pass to the exhause. This method of construction results in increased efficiency, both from the standpoint of mechanical work and economy. Another beneficial result of using only one wheel is the elimination of packing between stages.

New Belle City Officers

The Belle City Manufacturing Company, manufacturers of individual and neighborhood threshing outfits and crawler attachments for Fordson Tractors, have recently introduced new capital into their Company which enables them to increase their production and bring out several new lines of equipment which have been in development for some time.

The new officers elected on September 13, are as follows: Mr. H. A. Reed, president and general manager; Mr. W. J. Tostevin, vice president; Mr. G. A. Nelson, secretary-treasurer, and Mr. H. A. Schultz, assistant secretary and assistant treasurer.

Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.

RATES PER INSERTION	1 Inch	2 Inches	3 Inches	4 Inches	5 Inches	6 Inches	8 Inches	9 Inches	10 Inches	12 Inches	15 Inches	20 Inches	30 Inches
1 Insertion	$3.75	$7.25	$10.75	$14.25	$17.75	$21.25	$28.25	$31.75	$35.25	$42.25	$56.25	$70.25	$105.00
2 Insertions	3.75	7.25	10.70	14.20	17.65	21.15	28.15	31.65	35.15	42.15	56.15	70.00	104.00
3 Insertions	3.75	7.20	10.65	14.15	17.55	21.05	28.05	31.55	35.10	42.05	56.05	69.75	103.00
4 Insertions	3.70	7.15	10.60	14.10	17.45	20.95	27.95	31.45	35.00	41.95	55.90	68.75	101.00
8 Insertions	3.65	7.05	10.50	14.00	17.25	20.75	27.75	31.25	34.80	41.75	55.70	67.50	98.00
13 Insertions	3.60	6.95	10.40	13.90	17.05	20.55	27.55	31.05	34.60	41.55	55.55	66.25	94.00
26 Insertions	3.50	6.75	10.20	13.70	16.65	20.05	27.05	30.65	34.20	41.05	55.05	64.00	88.00

INFORMATION—*"Broadcast"* space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width. The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

It Pays to Advertise in PIT and QUARRY

The Schneider Sand and Gravel Co., Clinton, Iowa, inserted a "wanted" advertisement for a crane in the August 3rd issue, and under date of August 11, 1927, they wrote that: *"In regards to our advertisement wish to say the results were more than satisfactory. We bought a crane."*

Complete Service Publishing Company

538 South Clark Street **CHICAGO**

Rebuilt Guaranteed Equipment Priced Right

COMPRESSORS

2—Steam driven Sullivan, 2-stage Compressors. One 1500 cu. ft.; one 950 cu. ft.
1—Sullivan 10x12 class W. G. 3, belt driven. Cap. 150 cu. ft.
11—Portable gasoline driven. Following makes: Chicago Pneumatic, Gardner, Ingersoll-Rand, Schram, Sullivan, Zin-Ho, Domestic. Capacities from 30 to 210 C. F. M.

CABLEWAY BUCKETS

1—Sauerman 1 yd. Class G with teeth, complete with all fittings and sheaves, etc., for 400 ft. span and 16x16x60 ft. mast with fittings.
1—1½ yd. Dull slack line excavator bucket, with teeth (New).
1—1 yd. Dull slack line excavator bucket, with teeth.
1—Green 1 yd. Drag Scraper bucket.
1—Sauerman 1 yd. Crescent Drag Scraper Bucket.

SAND PUMPS

2—Morris, 8-in., direct connected to double 7x7 steam engine.
1—Morris 6 in. direct connected 8x8 single cylinder steam engine.
1—12-in. Morris belt driven.

SCREENS

1—48 in. x 108 in. Weller scalping screen.
1—30-inch Telsmith gravel screen.
1—Sackett 30 in. x 9 ft. with ¾ in. perforations.

CRANES and SHOVELS

1—Class 14 Bucyrus, with 65 ft. boom, 2¼-yd. Page dragline bucket; skid roller machine with special 4 truck mounting on 4 corners. Shop No. 3493.
1—McMyler No. 2 Crane, mounted on caterpillars, 40-ft. boom, steam. Shop No. 3394.
1—Byers, model 10, on half cats., fully revolving, steam.
3—Type B Erie shovels on caterpillars, Nos. 3900, and 2375 high lift boom ¾ yd. dipper. No. 3025 standard boom 1 yd. dipper. All with 40-ft. crane booms if desired.
1—Type A-1 new, on traction wheels, ⅞-yd. dipper.

DRILLS

1—Keystone No. 3½ steam Well Drills with tools for 5½ inch blast hole.
22—DCRW-23 Ingersoll-Rand, for 1-in. steel.
6—DCR-23 Ingersoll-Rand, for ⅞-in. steel.

DERRICKS

83—American Stiff Leg Derricks. Capacity 5 to 8 tons, with 14-in. square timbers, booms from 50 to 70 ft., with 12-ft. steel bull wheel.
32—American Stiff Leg Derricks. Capacity 8 to 12 tons, with 16 in. square masts, booms from 60 to 80 ft., with truss rods and 16-ft. steel bull wheel. Above derricks can be furnished for hook work or bucket operation.
2—Terry Steel Guy Derricks, 115-ft. mast, 100-ft. boom, 20-ft. bull wheel, capacity 15 tons with boom flat. One bucket operating.

HOISTS

2—135-H.P. American 3-drum electric A.C. motors.
2—100 H.P. 3-drum hoists with G. E., alternating current motors and two 15 H.P. separate swingers.
1—American 3-drum with attached swinger, with 50 H.P. G. E. motor, alternating current.
40—American double drum, hoists, with attached swinging gear, capacity 6000 lbs. on a single line, with 37 to 50-H.P. A. C., 60 cy., 3 ph. 220 or 440 v. motor, or with 35-H.P., 220-v. direct current motor. Can also furnish with new 55-H.P. Climax 4 cyl. gasoline engine.
6—Single drum, high speed, Electric Concrete Tower Hoists; Flory, Lambert, Lidgerwood and Thomas. 100-H.P., 75-H.P. and 50-H.P.
3—Lidgerwood 3 drum, skeleton, 1—12x12, 1—10x10, 1—9x10.
74—3-drum, 2-drum and single drum, size 12x12, 10x12, 9x10, 8¼x10, 7x10, 6¼x10, 5½x8, 4¾x6, all makes, also separate and attached swingers.

LOCOMOTIVES

3—Porter 6-wheel, standard gauge Switchers, with tenders, cylinders 18x24; weight working order 105,000 lbs. on drivers; tender weight 72,000 lbs. New, July, 1925, used 6 months.
1—Davenport, standard gauge, 10x16, 20-ton. Shop No. 1497.
2—Porter, 10x16, 18-ton, 36-in. gauge, Shop No. 4619 and 4667.
7—Gasoline Locomotives. Three 7-ton Whitcomb, 24-in. gauge; two 7-ton Whitcomb, 36-in. gauge; one 5-ton Whitcomb, 36-in. gauge.

Write for Stock List No. 115—Listing a Million Dollars Worth of Equipment—For Sale or Rent.

Equipment Corporation of America

PHILADELPHIA, PA.
660 Horn Bldg., 1601 Chestnut St.

CHICAGO, ILL.
1460 Roanoke Bldg.

PITTSBURGH, PA.
860 Empire Bldg.

HOISTS

STEAM ELECTRIC AND GASOLINE

LOCOMOTIVE CRANE

1—5-ton Industrial, 4 wheel, 40-ft. boom, standard gauge, prime condition. Price, $1200, tracks, Bridgeport, Conn.

MALLORY MACHINERY CORPORATION **Baltimore, Md.**

FOR SALE

1—A-14 Ruggles-Coles Dryer, fully equipped with 100 H. P. 440 volts, 3 phase, A. C. Motor.
1—No. 6 Jumbo Williams Crusher, Shop No. 2089, fully equipped with 150 H.P. 3 phase, 60 cycles motor.
2—No. 5 McCully Gyratory Stone Crushers with A. C. Motors.
5—4-Roller Raymond Mills Complete with motors. Full details and very low reasonable prices quoted if interested.

CRESCENT PORTLAND CEMENT COMPANY
Wampum, Lawrence County, Pa.

MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

A. D. WARNER, JR.

A. D. Warner, Jr., is Vice-President and Treasurer of the American Lime and Stone Company and the Charles Warner Company.